



REPUBLIC OF TUNISIA

Information and Communications Technology
Contribution to Growth and Employment Generation

VOLUME II - TECHNICAL REPORT

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PREFACE

This technical report note is the second of two volumes, drafted in conjunction with a policy note. It was prepared in response to a request by the Government of Tunisia for Bank assistance to formulate an ICT development strategy, in accordance with the targets set in the Government of Tunisia's 10th Development Plan. This report, in conjunction with the policy note, highlights current constraints to ICT sector development and proposes a strategy to eliminate them. The strategy is aimed at bolstering the country's emerging ICT sector and maximizing its ability to compete in local, regional, and global markets. In this context, its major objectives are to: (a) maximize the ICT contribution to growth and employment generation; (b) position Tunisia in the global ICT market; and (c) integrate ICT into the Tunisian economy. Indirect issues of the ICT impact on productivity and competitiveness are marginally treated in this report.

The report compares the state of ICT development in Tunisia that of other economies, taking into account Tunisia's relative strengths and weaknesses in developing a competitive and robust ICT industry. The report outlines the pillars of a strategy and specifies measures to be implemented by the Government, the private sector, and other stakeholders.

The analysis and recommendations in this report are based on the findings of a World Bank team that visited Tunisia in March 2001 and May 2001. It is the result of intensive consultations among the Bank team, the working groups coordinated by the Ministry of Communications Technology and including : the Ministry of International cooperation, the Ministry of Economic Development, Ministry of Higher Education, SEI, Tunisie Telecom, ATI, INT, ANCE, ANF, Technological Park of communications and ISET'Com. It also incorporates information that the Bank team obtained in discussion with some 40 companies in the Tunisian ICT sector. Structured discussions in the form of "brainstorming" sessions were held with selected Tunisian software and IT entrepreneurs to gain additional insights into the sector's competitive strengths, weaknesses, and opportunities. The Bank team, and the authors of the report, consisted of Hamid Alavi (team leader, MNSIF), Samia Melhem (CITPO), Carlo Maria Rossotto (CITPO), and Aristomene Varoudakis (DECPG). The Bank team was assisted by a team of consultants composed of Mustapha Mezghani, Mari Rantanen, Kishore Rao, Risto Riihimaki, and Jari Pentti. Marianne Stigset (MNSIF), Anupama Dokeniya (CITPO), Mather Pfeiffenberger (CITPO) and Rim Bellhaj (Hubert H. Humphrey fellow) also contributed to this report. David Satola (LEGPS) reviewed the sections on legal and regulatory issues and contributed to the draft of proposed measures in the regulatory area. Peer reviewers for the report were Bjorn Wellenius (consultant) and Govindan Nair (CITPO). The strategy benefited from a survey of ICT enterprises and government agencies, completed in July 2001. The contribution of the Finnish Consultant Trust Fund to the preparation of this report is gratefully acknowledged.

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I. Introduction

A. Background

The knowledge economy is characterized by global competition based on an efficient and high quality information infrastructure with no geographical boundaries. The information and communication technology (ICT) revolution is now sweeping the world, and despite the recent slowdown, the ICT industry has grown to be the principal driving force behind the world economy. The main challenge for governments is to become increasingly proactive rather than reactive in the development of their ICT industries. Many nations, including those in MENA, recognize this reality and are developing and implementing their own ICT strategies. Recognizing the importance of information in economic development, the Tunisian government (GoT) has recently embarked on a large reform effort and is making progress in creating appropriate conditions for private sector involvement in the sector and for integrating ICT in its economy. In line with this new approach, the GoT has asked Bank's assistance to develop an ICT development strategy to increase the contribution of this industry in economic growth and employment generation, in line with the objectives of the 10th Development Plan.

Why a Strategy for ICT Development?

The success of the ICT in developing countries such as Chile, India, Malaysia and Brazil can be traced, in part, to the early adoption of integrated and comprehensive development strategies for the ICT sector. The early development of an ICT strategy can create a blueprint for the balanced development of the sector, emphasizing priority opportunities and actions, but ensuring that initiatives are market-led.

In a globally integrated environment, information and communications services can generate substantial benefits for countries implementing adequate enabling policies. Recognizing these opportunities, the Government of Tunisia is placing increasing emphasis on promoting the ICT sector as a key element of its private sector development strategy. Expected benefits include:

Fostering economic growth. In high-income countries, ICT growth consistently exceeded the growth rate of the overall economy in the 90s. It thus has boosted directly economic growth. But in addition to being a high growth sector *per se*, ICT growth has positive externalities for growth and productivity in other sectors of the economy. Falling costs of key networking technologies benefit communications intensive industries that provide key "backbone services" to the economy, such as transport, distribution and finance. Investments in Information Technology across economic sectors also reduce transaction costs and increase the effectiveness of production and marketing efforts, thus fostering productivity growth.

Generating employment. ICT development can generate employment in telecommunications- and information-intensive activities, employing skilled personnel. With the right institutional and policy framework in place, ICT development can also stimulate employment generation in the rest of the economy, thanks to ICT-driven economic growth.

Enhancing competitiveness and improving Tunisia's integration in the global economy. International experience shows that the growth of ICT can be an engine for private sector development and help attract Foreign Direct Investment. ICT also facilitates diffusion of knowledge, allows to link up technological developments more closely to businesses, and also improves international technology transfers. Thus, ICT development helps exporters better

position their products in the global market place, as shown by emerging markets that have reaped similar benefits.

Reducing poverty. ICT development helps overcome poverty by enhancing opportunity, empowering people, and improving security. Its effects are felt both indirectly, thanks to faster economic growth, and directly – by narrowing the knowledge divide, improving services for the poor, and speeding warning and response to security threats (natural disasters, environmental problems, epidemics).¹

B. Focus of the Present Report

This Report has been prepared in response to a request by the Government of Tunisia for Bank assistance to formulate an ICT development strategy, in accordance with the targets set in the Tunisian Government's 10th Plan. The Report outlines strategies and related measures that can help achieve the growth and employment objectives of the Government in the ICT industry. These objectives have been conveyed to the World Bank team in May 2001. The strategy is aimed to bolster the country's emerging ICT sector and maximize its ability to compete in local, regional and global markets. In this context, the major objectives of the ICT strategy are to: (a) maximize the contribution of ICT to growth and employment generation; (b) position Tunisia in the global ICT market; and (c) integrate ICT in the Tunisian economy. Larger and indirect issues of the impact of ICT on macroeconomic productivity and competitiveness are not directly treated in this Report. Moreover, the focus of the strategy is on ICT services rather than equipment.

Defining an Appropriate Time Frame

A strategy to maximize the benefits of ICT development needs to be cast in an appropriate time frame. International experience suggests that the **economic spillover effects** of ICT sector development shows up in **successive rounds**, as more transmission channels of the growth impulse to the rest of the economy are progressively being activated. The *growth impulse* of ICT development is first felt on the *demand side* of the economy, through a growing size of the ICT sector. But progressively, the impact is transmitted to the *supply side*, through cost and productivity improvements in a wide array of *ICT-using* sectors. Supply-side improvements also occur in successive rounds:

- ICT development will reduce transaction and production costs of ICT-using sectors. Industries that use ICT services more intensively would see their costs trimmed more sharply. This will be reflected in lower prices and better competitiveness, thus fostering non-inflationary output growth.
- More remote benefits will occur from better network infrastructure, lower cost of data transmission, and the expansion of the IT business services, which will encourage a wide range of industries to invest in ICT technology. This would induce economy-wide spillovers of ICT-driven productivity improvements.²

¹ [World Bank, "Knowledge for All" working paper, 2000]. OECD report on the "Digital Divide", 2000. World Bank, "ICT Sector Strategy Paper", 2001.

² Two main channels transmit those long-term productivity improvements to the economy: (i) Direct improvement of labor productivity *within ICT-using sectors*, thanks to stepped up *capital deepening* driven by investment in ICT; (ii) Indirect improvement in efficiency and multifactor productivity through *spillovers* of improvements across economic sectors. Such efficiency spillovers may for example stem from B2B E-commerce, from disintermediation thanks to expanded use of the internet and to B2C E-commerce – but also reflecting lower administrative cost burdens thanks to E-government applications (such as eprocurement).

Productivity growth will thus eventually accelerate, generating permanent growth benefits for the economy. While the growth impact of the demand impulse and immediate cost savings of ICT development would progressively die out, as those effects boost the level of GDP only in a one-off way, more rapid productivity gains are likely to take over as the main driver of growth in the long run.

Global experience also suggests that, depending on the time horizon and on the ICT market segment considered, the **drivers of ICT development** may be different. In the *short-term*, the domestic market may play a larger role, at least in the case of Telecommunications and Networking services. But growth in the IT segment in the medium-term is likely to be driven by external demand, over time, based on the competitive advantages of Tunisia on the global and regional marketplaces, as in an emerging middle-income economy such as Tunisia the domestic market for IT applications is still narrow.

The present report **identifies and prioritizes the key measures for an ICT sector development strategy**, seeking to maximize the short term benefits in terms of growth and employment generation, while at the same time laying the ground for further diffusion of the benefits of ICT development in the long term. The report highlights strategic choices with the aim of taking full advantage of the *short-term drivers* of ICT development by: (i) fostering the momentum of the domestic market in the telecommunications segment and creating the right infrastructure for ICT development; and (ii) building on the competitive advantages of Tunisia on the global and regional ICT markets to boost growth of the ICT industry.

The preconditions to foster these drivers of ICT development are not necessarily the same as the policies that will need to be deployed in a second stage, to enhance the diffusion of ICT development into the rest of the economy.

The assessment of the broader economic benefits of ICT development is also framed by this choice of strategy. The report examines in detail the growth and employment benefits from ICT development during the initial rounds of ICT development, where the impact will be mostly felt on the demand side of the economy and through one-off reduction in costs of ICT-intensive sectors. However, the report also provides some guidance, as to the likely size of the effects in the long term, when the impact will be felt mainly through stepped up productivity growth, though the projection of these effects is tentative and surrounded with considerable uncertainty.

C. Methodology

This report is the result of intensive consultations between the World Bank team and the working groups of the Ministry of Communications Technology, and numerous officials from various parts of the Tunisian government. It also incorporates discussions that the Bank team has had with some 40 companies in the Tunisian ICT sector. Structured discussions in the form of “brain storming” sessions were held with selected Tunisian software and IT entrepreneurs to gain additional insights in terms of competitive strengths, weaknesses and opportunities.

Additionally, to provide a firmer basis for the analyses and assessments, an extensive survey of Tunisian ICT firms – in various segments of the industry – was conducted. Investigations are also proceeding in terms of gaining further insight on the impact of ICT on traditional, so-called “bricks and mortar” industries such as tourism and textiles.

II. ICT Services—Definition, Market Structure and Trends

The ICT Services industry encompasses a large number of sub-segments and activities that are rapidly evolving. Previously distinct activities are converging. Advances in technology—especially the proliferation of the World Wide Web and new telecommunications facilities—are giving rise to entirely new applications and service activities. The global information and communications revolution is the result of three major developments:

- Rapid expansion of the Internet and e-commerce.** Currently, there are some 350 million Internet users worldwide, growing at a rate of 150,000 persons per day. By 2005, more than 1 billion people will have Internet access.³ A total of 2.1 billion web pages are in existence—compared to 100 million in 1997—with almost 2 million pages being added each day. There are over 100 million Internet hosts worldwide, an increase of almost 100% over 1999. Global e-commerce transactions amounted to US\$150 billion in 1999, and are expected to reach US\$2-3 trillion by 2003.

Table 2.1 - Internet Users by Region (Millions)

Region	1998	1999	2000	2001	2002	2003
North America	90.4	108.8	136.9	141.5	157.3	171.0
Western Europe	38.9	57.9	74.0	87.0	102.5	112.0
Asia/Pacific	31.7	47.8	68.9	85.0	108.9	138.8
Latin America	5.4	9.3	10.7	20.1	27.8	37.6
Eastern Europe	3.1	5.8	9.4	13.0	17.9	24.1
Africa	0.9	1.5	2.6	3.2	4.4	6.1
Middle East	0.8	1.4	1.9	3.6	5.5	8.5
Total	171.2	232.5	304.4	353.4	424.3	498.1

- Dramatic increases in computing power, connectivity and software capabilities.** Computer and communication technologies have improved dramatically. The number of transistors per microprocessor chip has been doubling every 18 to 24 months since the 1960s, resulting in massive increases in processing power. The capacity of computer hard disk drives is doubling every nine months. Similar improvements have taken place in communications technology, especially in terms of the speed of data communications and infrastructure capacities.
- Sharp cost reductions.** Technological advances have led to steep and continuing declines in hardware and communication costs. Between 1994 and 1998, for example, the price of telecommunications equipment fell by an average of 2% per year. The costs of equipment and technology are currently only 20% of levels five years ago, and are projected to fall to only one-fifth of today's prices within five years. These costs are contingent however, upon the regulators' successful tackling of the monopoly of state owned companies.

These factors have combined to profoundly affect the global economy in ways that are only now being fully realized. At the macro level, there is increasing evidence of the positive impact of ICT and the Internet on productivity growth. At the micro-level, the Internet is revolutionizing business operations both by dramatically reducing costs and increasing access to consumers. These factors are giving rise to new software and ICT services activities.

This Annex provides a brief overview of the global and regional market structure and trends of the main segments of the ICT services industry—Software and Software Services; IT Services; Advanced Media Services; E-commerce related activities; and Telecommunications and Networking Services. It is intended to provide an overall context for development of a Tunisian ICT strategy.

³ NUA Internet Surveys, February 2001.

A. Defining the ICT Industry

A comprehensive and accurate definition of the ICT industry does not exist. In large part, this is due to the on-going convergence of traditionally distinct information technology, telecommunications and information content activities, as well as blurring distinctions between ICT “products” and “services.” There are various efforts under the aegis of the OECD, UN and other agencies to develop an internationally acceptable definition, as the limitations of the ISIC system as applied to this area have been widely recognized. However, the impact of the lack of an international standard definition goes beyond mere definitional issues. It complicates the measurement of the industry, and makes cross-country and cross-sectoral comparisons very difficult and at times misleading. For the purposes of this report, we have adopted a simplified definition of the industry and its main component sub-sectors.

Generally, the ICT industry can be categorized into the following broad sectors:

- **Telecommunications Equipment.** This segment includes all firms that manufacture, assemble, test and deploy telecommunications equipment, such as switches, hubs, receivers and cables. An example of a Tunisian firm in this field is Omnicom, which specializes in Wireless in the Local Loop (WLL) equipment.
- **Computer Equipment Hardware.** These companies resell computers, workstations and servers. Some may import parts of equipment and assemble them in house and resell them under a generic brand. A Tunisian example is Alis Computer.
- **Telecommunications services.** This segment includes providers of telecommunications services (such as voice services for local and international communications, data services), over telecommunications networks (fixed, mobile and satellite). An example is Tunisie Telecom.
- **Networking services.** Networking includes firms involved in the provision of services to install, integrate, and maintain communications and information networks, in the context of corporate Local Area Networks (LANs) and Wide Area Networks (WANs). Networking firms also serve large telecommunications public networks. Examples of firms in this segment are SOTETEL and Netcom.
- **Software and Software Services.** These companies sell either packaged applications (such as Microsoft Office) or customized solutions with support, training and maintenance services. Tailored custom applications are prepared for individual large enterprises, or specific “vertical markets.” Software services” are components of the software development and maintenance process that are outsourced to independent vendors, increasingly in offshore locations. Examples of leading software development firms in Tunisia are SPG and BFI.
- **IT-Enabled Services** encompass a diverse set of activities characterized by a high intensity of communications and information processing. Usually, they are highly labor-intensive. Major segments include data conversion operations (e.g., data entry); voice center operations (such as call centers); and various “back office and professional services (such as engineering, accounting, etc., being undertaken in offshore locations). An example in Tunisia is Tunis Call Centre.
- **Advanced Media Services.** This segment includes both firms engaged in the development of digital content (CD Roms, instructional software for e-learning, Web development, video and

music), and providers of conditional access media services (pay-TV, digital TV, cable and satellite television). Examples are MRS and Canal Horizon.

Table 2.2 presents the proposed classification of the ICT industry⁴.

Table 2.2 – Definition of the ICT Industry

Sector	Segment
1. Telecommunications Equipment	Manufacturing, Assembly, Testing, Deployment
2. Computer Equipment Hardware	Assembly, Configuration, Customization, Rollout, Maintenance repair and operations, Asset management
3. Telecommunications Services	Fixed Voice Telephony Services, Cellular, Paging and other Mobile Services, Data Services, Internet Services Provision, Virtual Private Networks Services, Other Telecommunications Services
4. Networking Services	Engineering, Maintenance Repair and Operations, Rollout and integration, Configuration management, Automated software distribution, Network management, Load balancing and monitoring, Security
5. Software and Software Services	Packaged software for general applications and vertical markets, Customized software for individual enterprises, Development platforms, Programming languages and Tools, Systems, Web Site development, Software Integration, Testing, Coding, Maintenance, Technical Support, Localization and Translation, Customization, Application Service Providers
6. IT-Enabled Services	Data Conversion (data entry, GIS, Medical transcription, Legal databases, Database management, Data Warehousing, Data mining); Voice Center Operations (Call Center, Reservation Centers, Insurance Claims Processing, Help Desk, Telemarketing); Back Office Operations
7. Advanced Media Services	Computer Graphics, Multimedia, Animation, Interactive Instructional material, Movies, Music, Games, Digital Content Creation, Datacasting/Digital Broadcasting, Cable

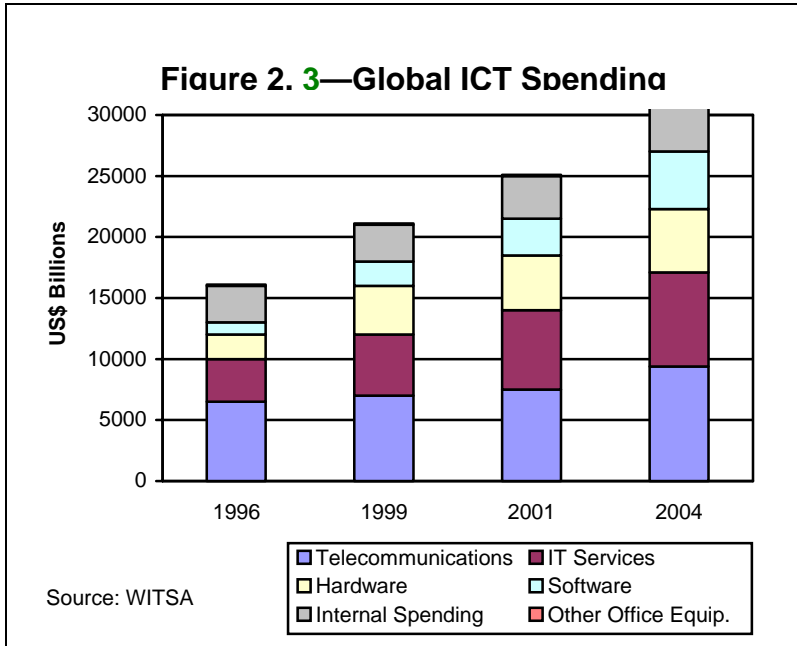
B. Global Markets

According to recent analyses conducted by the World Information Technology Services Association (WITSA), the global ICT market is expected to exceed US\$3 trillion by 2004.⁵

The most significant growth will come from telecommunications and IT services, rather than hardware, reflecting the growing importance of the Internet. This is a significant shift from the early 1990s, when IT hardware investments were the major catalyst to growth.

⁴ Please refer to Annex 1 for a more complete discussion of the various segments of the ICT industry and major global and regional trends.

⁵ WITSA, "Digital Planet 2000."



The significant growth forecast of the world ICT economy – rising from US\$2 trillion to US\$3 trillion in five years – is the result of several catalytic factors, including:

- Continued development of the Internet through use of wireless technologies; broadband networks; and intelligent devices
- Accelerated privatization of telecommunications

and other ICT markets

- e-Transformation of traditional business models and adoption of e-business models
- Harmonization of international laws and regulations on ICT issues such as security, privacy, taxation
- Emergence of major new ICT markets such as India, China and Brazil

While there are legitimate concerns about the current downturn in the ICT economy, short-term prospects for expansion remain healthy according to most experts

Software and Software Services

The world market for software and computing services has grown rapidly over the past few years. Between 1996 and 2000, the world market has increased from about US\$304 billion to US\$585 billion⁶. Packaged software products account for about 34% of the total; software services comprise for the remainder. With the current economic slow down in the United States, the growth of the market has slowed sharply. Market experts have downscaled their forecasts as a response; the world market is not expected to exceed US\$700 billion by end-2002⁷. However, medium-term demand is expected to be strong; IDC projects packaged software sales to increase to US\$310 billion in 2005.

The United States is the largest producer and consumer of software and computing services (at about 45%), followed by Western Europe at 26%. Growth in the Western European markets has been the strongest among the OECD countries, and annual growth rates are expected to average 13-14% for the next few years. While Germany and the UK are the largest software and computing services markets in Western Europe, France is expected to experience above-average growth rates in the coming years.⁸

⁶ IDC data.

⁷ Countries such as India that are dependent on the US market are experiencing slow-downs in their software export activity. Several hundred IT professionals have been laid off and many professionals have returned from the United States.

⁸ "The 2000 Holway Report," Richard Holway Ltd.

However, the highest growth has been recorded in emerging economies, where annual growth rates – albeit starting from a low base – have ranged from 12-50% over the past five years. Eastern European and Asian countries have had the highest growth rates, followed by Latin American nations.

A number of factors are affecting the competitive environment for software products and services. The main one is the impact of the **Internet**. The Internet is leading to a number of profound changes including accelerating the conversion of existing software and IT services and products into Web-enabled applications and facilitating the development of new software products aimed at Web-based activities. Another factor is the increased competition that traditional, “shrink wrapped” software products are receiving from **application service providers** (ASPs), which rent software applications to businesses, hosted on off-site data centers. Another notable trend is the movement toward so-called “**open source**” applications such as Linux and other operating systems. Software development opportunities are also increasingly influenced by the advent of **web services**, which enable close and direct integration of distributed databases over the Internet.

These developments are leading to many new software development opportunities, including Enterprise Resource Planning, Customer Relationship Management, Data and Knowledge Management, Enterprise Application Integration, Supply Chain Management, etc.

These new tools are being applied in a wide range of “**vertical markets**,” including specific industry sectors and a variety of “cross-industry” functions (such as accounting, project management, etc.). Of specific interest in the Tunisian context are the most promising vertical market applications now emerging. Among the most important include:

- E-commerce and e-government related applications including database management; access technology; security and authentication systems⁹
- Telecommunications – despite the slowdown in the industry, there are strong opportunities for billing/customer care; network management; call center technologies and other applications
- Financial services, especially e-banking services and the creation of “open finance” systems
- Retail industry – online software to support sales-based and buy-side applications
- Media and multimedia software for games, film, broadcasting and other markets
- Logistics and supply chain management
- Healthcare – manufacturing informatics, embedded software, CRM, support for telemedicine applications
- Training and education, both computer- and web-based training for consumer, education and corporate markets

A significant activity for developing countries – but still a small share of the global software and computing services market – is the phenomenon of **offshore software services**, particularly coding and programming operations. Unfortunately, there are no accurate statistics on the size of the offshore software services markets. Available information indicates that global software exports of developing countries (i.e., India, China, Philippines, Russia, Mexico, Brazil, etc.) last year was about US\$10–20 billion, a significant part originating from India.

⁹ The worldwide e-government applications market alone is estimated by Forrester Research to be US\$55 billion, growing at 15% annually.

Offshore software development companies typically undertake lower-end, labor-intensive activities (such as coding, testing, technical support, localization) in support of global software development activities. Higher value tasks such as system engineering; client specification and needs analysis; design; maintenance; etc., remained in the developed country client site.

In recent years, however, this distinction between on- and off-shore activities is blurring. The new model is one of “globally distributed “ software development teams. Tasks and activities are contracted according to the unique skills and track record of companies in any one location. Labor cost differentials are becoming less important as a determining factor. The trend toward closer integration of onshore and offshore operations is reinforced with the emergence of the Internet. One impact of the Internet on offshore development is the ability for smaller companies to both contract and deliver software services using electronic B2B vertical marketplaces.

IT-Enabled Services

Table 2.4 - Global Market for IT Services (US\$B)

Sub-Segment	1998	2008	CAGR
Customer services	\$6.5	\$33.0	18%
Finance & accounting	\$1.5	\$15.0	26%
Translation and transcription	\$1.3	\$20.0	4%
Engineering & design	\$0.3	\$1.2	21%
Human resource services	\$0.4	\$5.0	29%
Data search, integration and management	\$0.2	\$44.0	71%
Remote education	--	\$18.0	--
Consulting	--	\$15.0	--
Web site services	--	\$5.0	--
Market research	--	\$3.0	--
Total	\$10.0	\$142.0	30%

Source: NASSCOM McKinsey, India IT Strategies, 1999

Given the lack of a consistent definition of the IT services industry and the dynamic impacts of technological innovation, it is hard to develop an accurate indication of overall market size. According to a study undertaken by McKinsey & Co, the international management consultancy, global market for IT-

enabled services are expected to exceed US\$142 billion by 2008, a dramatic increase from the US\$10 billion estimated in 1998¹⁰.

The global market is dominated by U.S. companies, including Fortune 500 companies that have set up captive facilities in countries like Ireland, Israel and India. Outsourcing of IT services has begun in Western Europe, but lags behind outsourcing of software development. The out-location of so-called back office professional services is at the beginning stages in the EU, and tends to favor other European locations such as Ireland. However, there is a growing trend favoring outsourcing of IT services and functions to India, some countries in Central Europe, Mauritius (especially for French language applications), and to a limited extent, North Africa.

The development of the offshore IT services industry is driven by the need for multinational companies to reduce business and transactions costs, and facilitated by falling telecommunications costs. International companies can realize cost savings of 40-50% from outsourcing non-core, back-office processes to lower cost locations. Many of these functions are not desirable in developed countries, leading to high labor turnover rates and poor quality. Even larger savings are possible in more sophisticated, white-collar work, given significant wage

¹⁰ Broader definitions of IT services – with the inclusion of advanced media services, including web enabled applications and basic research and development, result in a much larger estimated market of close to US\$250 billion in 2008. This is significantly larger than the current size of the global packaged software industry currently estimated at about US\$150 billion.

differentials for such workers between OECD and developing countries. Unlike software development—which is sensitive to cyclical trends such as the recent US economic downturn—companies are always under pressure to reduce back-office operating costs.¹¹

Advanced Media Services

The advanced media services industry is an emerging market segment that incorporates a diverse range of activities increasingly undertaken in offshore locations. The growth of the Internet and the convergence of broadcast and Internet technologies are creating a major market for streaming audio, video, text, animation and other media content. The world **Multimedia/Computer Graphics** industry encompasses a broad range of activities. Recent estimates place the world multimedia market at about US\$25 billion, expanding to US\$50 billion by 2003. A sub-segment of this market that is developing quickly is **Streaming Media/Broadband** technology-based applications.

Another enormous market arising through the convergence of telecommunications, media, information and business services are **conditional access services**, including pay TV, TV on demand, cable, digital broadcasting and data casting. These services are growing rapidly, spurred by the introduction of digital TV in many economies. In some part, digital broadcasting technologies are in competition with Internet-based applications, such as Streaming Media.

Technological advances including convergence of broadcast media and the Internet are creating enormous opportunities for **digital content development** and related activities. The Internet content market alone is estimated at being around US\$25 billion in annual revenues, and expected to reach US\$100 billion by 2004. It is one of the fastest growing segments of the global IT services industry.

Computer Animation is another rapidly growing market segment. In 1999, global animation revenues were estimated at US\$25 billion, and projected to grow to US\$70 billion by 2005.¹² At end-1999, North America (principally the US) had a 46.9% market share; followed by the UK and Europe with 25.1% and Asia/Pacific with 28% of global sales. Over the past few years, there has been reduction in the US and European market shares; Asia has emerged as a major offshore supplier with total revenues of about US\$7 billion annually. Leading Asian animation locations include Japan, South Korea, China, India, Philippines and Viet Nam. Globally, the industry is dominated by a few large companies, and over 7,000 small-medium sized companies, with average revenues of less than US\$1 million each.

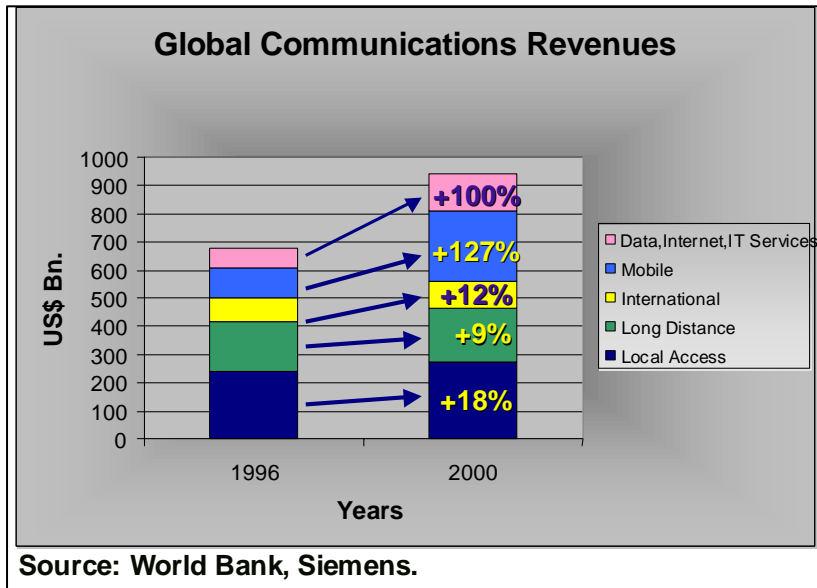
On-line education, or e-learning, represents a major emerging commercial opportunity for content development. The size of the e-learning market—corporate, student and consumer—is immense, ranging from estimates of about US\$1.1 billion to US\$2 trillion, if all so-called “knowledge services” are included. Last year alone, US expenditures on education and corporate learning exceeded US\$740 billion; EU expenditures were in excess of US\$1.2 billion. The growing size of the global and regional market is providing enormous opportunities for software and content developers.

¹¹ The Economist Magazine, “Outsourcing to India,” May 5th, 2001.

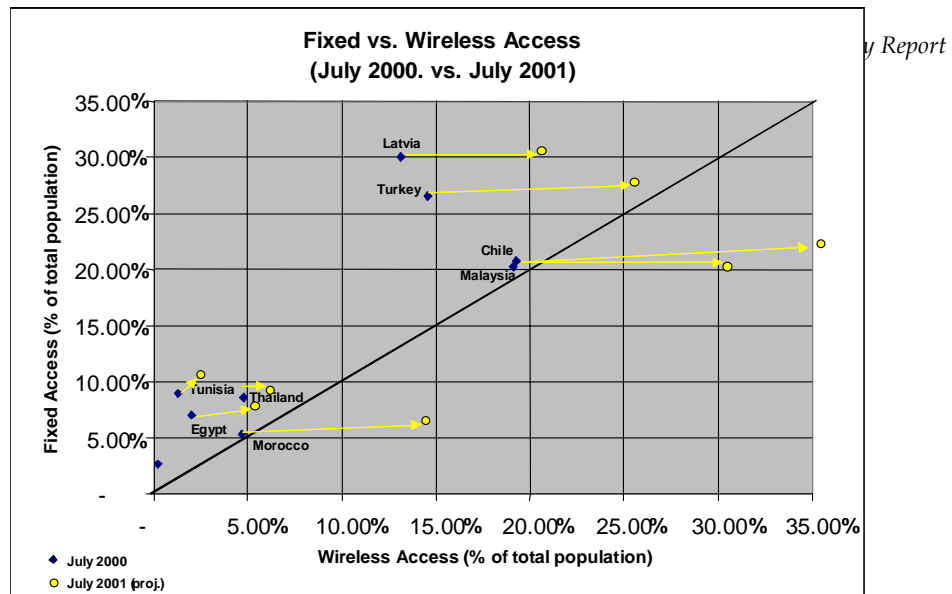
¹² “The Global Computer Animation Industry,” Robi Roncarelli,

Telecommunications Services

The telecommunications industry was a **high growth industry** in the years 1995-2000, mainly related to the strong growth of mobile and Internet services. In these years, global communications revenues have grown from US\$650 Bn. to over US\$900 Bn. in 2000. Different telecommunications services experienced different growth rates. For example, **traditional voice telephony** (local, long distance and international over fixed line networks) has grown at historic rates. In particular, technological development (Internet telephony), and pressures over the traditional international settlements rates, have reduced the growth rate of revenues generated by **international telephony**, and affected profit margins. As a consequence, traditional telecommunications operators, which relied heavily in revenues from international services, needed to change their strategy, expanding their operations in **mobile, data and professional services**. At the same time, specialized mobile, Internet and data operators established themselves as powerful competitors to the incumbent operators. The increased competition in these market segments generated a boom in revenues from mobile and data services, which grew, respectively by 127% and 100% in the years 1996-2000. As a consequence, mobile and Internet revenues represent about 45% of the global communications revenues, compared to only 25% four years before.



A second important global trend is the increased importance of wireless solutions in the provision of basic access. If we compare the data between July 2000 and July 2001, we can report that there was a substantial migration towards **wireless access**. Developing countries, in particular, championed this growth, as the introduction of competition in mobile communications, and the consequent sharp reduction in prices and product and marketing innovations (the most important of which is pre-paid cards), allowed the extension of access through mobile telephony in rural and urban low income areas. Examples of this migration are countries like Morocco, Chile and Malaysia.



On the **financial side**, the increased competition in wireless and data, and the decline of profit margins in traditional telephony, has led to some important developments:

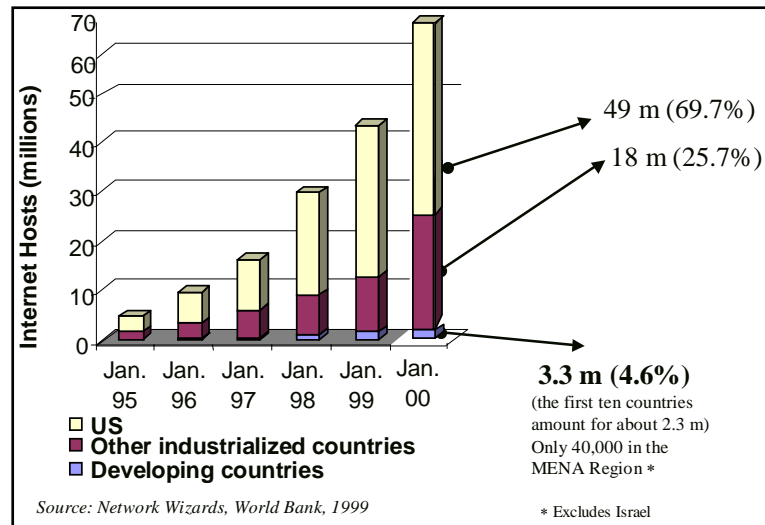
- Growth of mergers and acquisitions in developed countries, to face competition and to establish multinational operations on a continental basis (e.g. Vodafone-Mannesmann, Ninex- Bell Atlantic, SBC-Ameritech);
- Growth of mergers and acquisitions driven by needs of product line diversification and convergence (e.g. AT&T-TCI, AOL-Time Warner);
- Increased interest in opportunities in developing countries, associated to higher profit margins and high potential growth, to cope with saturation and increased competition of domestic markets in developed countries;
- Aggressive bidding on 3G licenses, especially in Europe, where mobile licenses were over-valued.

These four developments had a multiple effect on the telecommunications industry in developing countries. On one hand, developing countries were able to attract a substantial share of the FDI in the sector in the last four years. On the other, the financial strains related to M&A financing and mobile auctions, drained the financial resources of the operators.

As a consequence, in 2001, the telecommunications industry has continued its high growth rate, in terms of revenues, but profit margins decreased, and in some cases operators faced losses, mainly due to increased financial charges. Even though consolidated statistics are not yet available on FDI trends to developing countries in 2001, this temporary financial crisis might have affected the flows of investments.

Networking Services

The networking industry has shown a growth pattern highly correlated to the growth rate of the telecommunications industry. In fact, the global expansion and rapid technological change in telecommunications networks acted as a stimulus for firms involved in the provision of services to install, integrate, and maintain communications and information networks. Demand came from two main classes of clients: the first are large telecommunications public networks (both incumbent and newcomers), and the second are corporate Local Area Networks (LANs) and Wide Area Networks (WANs).



The **strong growth in IP-based networks**, in particular, fuelled by Internet penetration, seems to have set an irreversible trend towards network extension and upgrade, as shown by the graph above. Wide disparities exist among different regions. The United States have about 70% of all Internet Hosts (as of January 2000), and the rest is mainly concentrated in other industrialized countries (Europe, Japan). Emerging markets account for only 5% of the global Internet hosts, although some areas are growing fast (e.g. **Latin America and East Asia**).

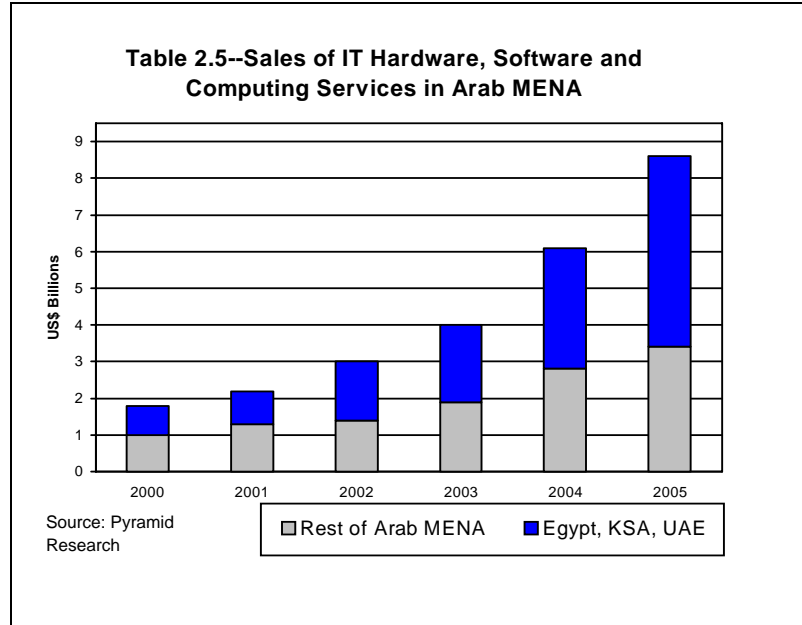
In the last two-three years, growth of the networking industry emerged as a **driver for many other segments of the ICT industry**. It positively affects hardware and equipment sales (routers, switches, hubs, modems, faxes, etc.), as well as high end software (security, firewalls, network management), may even accelerate IT-enabled segments, by fostering creation of network management centers, hosting services (such as for applications). Convergence of voice and data networks, and the emergence of multimedia applications, will consolidate the role of the networking industry as a driver of ICT sector growth.

However, capital markets overshooting in telecommunications also affected the networking industry (Cisco, Nortel, Lucent, Ericsson), whose profits in 2001 suffered from lower demand and write-downs (due to lower valuation). Lower demand for networking services can be explained by decreased capital spending in IT by the US corporate sector, which, in turn, reflects over-investment in 1998 and 1999, and revised expectations economic depression.

C. Regional Markets

Comprehensive statistics on the structure, size and dynamics of the **MENA software and computing services markets** are largely unavailable. However, all signs point to the fact that the MENA market is one of the fastest growing in the world.

Table 2.5 presents a forecast of the growth of the Arab MENA market, including IT hardware equipment expenditures. The total market is forecast to grow from less than US\$2 billion to US\$8.5 billion in 2005.

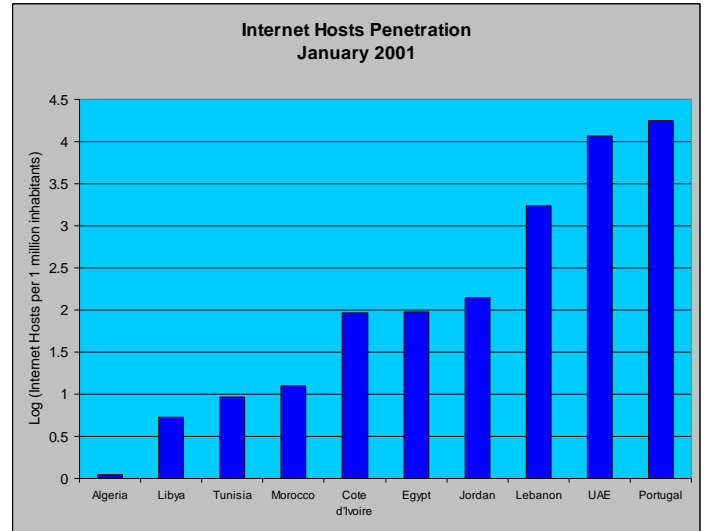
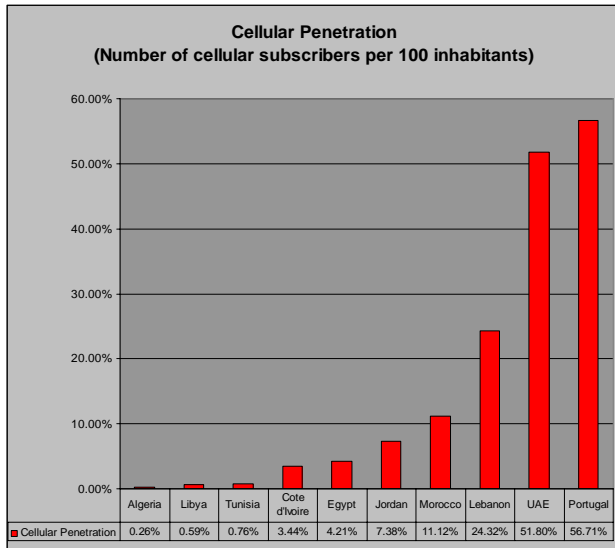


Last year, ICT revenues in Arab MENA were highly concentrated, both in geographical and product/service terms. Three countries—Egypt, Saudi Arabia and the UAE, accounted for about 60% of the total figure. Figure 2.2 depicts the breakdown of ICT revenue by segment. As shown, ICT activity was dominated by telecommunications services, telecommunications equipment, and computer hardware.

Software, IT enabled services and other ICT services accounted for a very small share of ICT revenues.

The most important Market trends in the region are:

- Growth of cellular telephony
- Increase in Internet subscribers but stagnation in number of hosts mostly due to content development issues such as lack of web developers creating local content, hosting issues and infrastructure weakness
- Increase of equipment sales (PCs, servers routers), mostly as businesses adopt ICTs and as government subsidizing the concept of family PC (Egypt, Tunisia)
- Concentration of FDI in telecommunications and networking services in Morocco, Egypt and Jordan; other ICT sectors in Dubai and Jordan.



There is an increased awareness of the importance of ICT for growth and employment generation in the region, and several governments have begun to focus on the development of national ICT strategies (Tunisia, Egypt, Jordan, Morocco, Algeria) and E-readiness studies. On the practical side, a number of countries have facilitated the creation of cyber-parks (Tunisia, Jordan, Morocco, Egypt, Dubai) call centers, incubators, and efforts to create a favorable business environment to encourage multinationals to invest in regional headquarters and manufacturing facilities in the region.

The main impediments to the Software and Computing Services industry in the region are the low levels of computer penetration; limited access to low cost, value-added telecommunications services; and software piracy rates. According to the Business Software Alliance, the average software piracy rate in the Middle East in 2000 was 57% of total packaged software sales, far higher than 37% worldwide average.

However, many of these impediments are being eased, accelerating the scope for increased software development activity in MENA. Software piracy rates are being reduced in several countries, due to accession to the WTO and implementation of IPR accords. Telecommunications markets are being privatized and deregulated, leading to quality enhancements and significant cost reductions in terms of Internet access and value-added services.

Still, software development activity remains at a limited level in most MENA countries. Firms tend to be small, lack critical technologies and project management know-how. Most firms concentrate on the domestic markets, which tend to be dominated by government procurement. Domestic commercial markets are small and extremely cost-sensitive.

The most important vertical markets being served include:

- Finance and insurance – e-banking is a major business opportunity¹³
- Software translation (Arabization) and localization¹⁴
- Military logistics and other defense applications
- Healthcare (especially automation of hospital systems)
- Web development activities
- Some multimedia and education
- Internet security
- Other e-commerce applications

However, while software development and related activities are present in MENA, the provision of IT services remains almost absent. A number of countries have made progress in developing these opportunities. A number of Jordanian firms are engaged in a variety of data conversion tasks for export markets. Call centers have been a significant growth opportunity in Morocco over the past year, resulting in large part from significant telecom sector deregulation. Egypt has a few companies engaged in offshore engineering and design, as well as remote education activities. But in general, the dominant emphasis in the region has been on the Software industry.

By 2004, the ICT market in Arab MENA is forecast to expand rapidly to almost US\$9 billion. According to Pyramid Research, the share of the top three countries—Egypt, UAE, Saudi Arabia—will fall as other countries gain market share. In addition, an rising share of revenues will be derived from telecommunications services (51%), software and services (12%), IT-enabled services (8%) and advanced media services (2%). As with global markets, this is a reflection of the greater importance of the Internet—rather than hardware investments—as a catalyst to ICT activity in MENA.

¹³ According to Pyramid Research, only 18 of the top 100 Arab banks currently offer e-banking services. Arab banks are under pressure to boost services and remain competitive in the face of deregulation of the financial services sector, and the entry of foreign banks. This is expected to boost demand for e-banking services.

¹⁴ The creation of Arabic web content is a major business opportunity. According to Global Reach, English language accounts for 51% of web users currently; non-English Internet usage is expected to grow up to 57% by 2005. Arabic language web users represent less than 1% of total web users and are projected to grow rapidly.

III. Tunisia's Competitive Position

The Tunisian Government considers ICT as an strategic industry at the heart of the information economy which will play an important role in growth and job creation, especially for young, educated Tunisians. It has accordingly begun a comprehensive reform of the telecommunications sector in order to create an enabling environment allowing private sector involvement. In line with this new policy, the Communication Law (January 2001) and E-commerce Law (August 2000) have been enacted, along with their implementation decrees, representing a basis for a pro-competitive ICT policy. These Laws open the grounds to competition and private participation.

In February 2001, President Ben Ali reaffirmed its administration's commitment to the development of "immaterial" economy and its support for the introduction of ICT in the Tunisian economy. Several measures were accordingly implemented to create an impetus and kick-start the process:

1. Contributing to 50 percent of the cost of Web site development by enterprises through the export promotion fund (FOPRODEX).
2. Authorizing enterprises to maintain their own Websites to insure appropriate content management and update.
3. Reducing the specialized line tariffs.
4. Creating enterprise incubators at the *Instituts supérieurs d'études technologiques* (ISET).
5. Creating cyberparks in several regions starting in 2002 with a focus on creating jobs for the young Tunisians (e.g., via call centers, etc.)

More importantly, the Government commitment is clear in the adoption of a policy to liberalize the sector and create an institutional structure to manage this transition. Several observations and of the Bank's private sector assessment regarding the needed reforms are now a reality in Tunisia: Communications Law, e-commerce law, *liasse unique*, etc. Moreover, the number of Publinets is increasing, the bandwidth has increased, access rates have declined, ISP duopoly has ended, and competition is being introduced in mobile telephony.

In addition, a new Ministry of Communication Technology has been established (February 2001), by integrating the old Ministry of Communications and the *Secrétariat d'État à l'Informatique* (SEI).¹⁵ This has allowed the integration under the same authority, of the key public sector elements that could interact with the private sector and other stakeholders to elaborate an ICT strategy.

A. Profile of Tunisia's ICT Sector

The growth potential of the ICT sector was until very recently inhibited by limited development of the telecommunications sector, due mainly to the monopoly of *Tunisie Telecom* (that operated

¹⁵ Key public organisms in the ICT sector (including training institutions) are under this new Ministry: Tunisie Télécom, Agence tunisienne d'Internet (ATI); la Poste Tunisienne; Centre d'Études et de Recherche des Télécommunications (CERT); Institut Supérieur des Études Technologiques en Communications (ISET'COM); Société Tunisienne d'Entreprises des Télécommunications (SOTETEL); Parc Technologique des Communications de Tunis; Institution de Recherches en Sciences Informatiques et en Télécommunications (IRSIT); Agence Nationale de Certification Électronique.

and regulated the sector) and excessive government intervention¹⁶. In particular, while the fixed line network has grown to 980,013 lines (as of March 31, 2001), more than other countries in the region, Tunisia has not yet benefited from growth in two segments that globally have shown highest potential: mobile communications and the Internet. For comparison, while Morocco has developed, in less than two years, a mobile network of 4 million subscribers (14 subscribers every 100 people), the number of GSM subscribers to *Tunisie Telecom* was 214,693 (2 subscribers every 100 people) at the end of March 2001.

At present, most ICT companies in Tunisia are concentrating on the fields of software sales and services; as well as application development. Their clients are either local companies or international clients (exports). The public sector represents at least half of the total Tunisian ICT workforce with a concentration in the fields of Telecoms and Networking services. As background to the Strategy Report, the World Bank has commissioned two surveys of the ICT sector, one for the public and another for the private sector in June/July 2001. Some of the results of the private sector study are reported in this section. Even though the ICT Survey concentrated on Software and application development firms, it also surveyed Telecoms and Networking companies, PC makers, and multimedia companies. The survey's results and final evaluation report are listed in Annex 5.

The ICT sector revenues in 2000 were composed of: \$100 Millions in PC and server equipment, \$20 Millions in accessories and peripherals (printers, faxes, cables) , approximately \$50 Millions in software and software services (software sales, application development, consulting, outsourcing, multimedia development etc.), \$370 Million telecom services, \$50 Million networking services and \$50 Million in IT enabled services, IT applications and advanced media services. Due to several government initiatives (Subsidized access through 6,000 Publinets, PC familial, Higher Education Reform and introduction of computing in secondary schools) it is likely that PC equipment local sales and imports will remain high for 2001-2003.

However the sector with most export potential remains that of software and application development, due in large part to the worldwide shortage of skilled ICT workers, and the unmet demand worldwide for these services. In that sector, Tunisia already has a few technology leaders specializing in niche markets such as cash management and asset management software for the Banking sector (e.g., BFI); or development of embedded software for international Telecom manufacturers.

Today this sector is still growing in Tunisia, with an explosion of young new, small software houses specializing in Web content development, multimedia and content management tools such as Java and Dreamweaver. These cohabitate with existing older companies (5-8 years old) which focus on more traditional database design, large MIS deployment, enterprise resource planning, network integration, etc. These companies are usually larger in size, (20 staff average); have partnerships with the International ICT community; and are experiencing employee retention problems. Their customer base is usually the local large companies (Banks, insurances, utilities, retailers, agro-business, etc.) Finally very few companies are much larger (100 plus to 300 employees) and these seem to focus on licensing their products for exports only.

Most ICT firms interviewed did not seem worried about competition even though many mentioned Eastern Europe, India, and Malaysia as competitors to the Tunisian software and application development exporters. The potential markets cited were mostly French speaking

¹⁶ In the Internet segment, for example, the Government required that web pages are hosted by Internet Service Providers, while in most countries, private enterprises are free to host websites by their premises.

countries and Regions (France, Canada, West Africa). Surprisingly the USA was never mentioned as a market, despite its renowned shortage in ICT skills.

Characteristics of the ICT companies

Most of these firms are small, average size less than 10 people, usually young people, with an average stay of 18 month per company despite the high salaries (Annex 1). These companies lack the advantage of bigger-sized software houses such as those found in India, Ireland or Canada; who can produce and re-use code modules much more efficiently, and who have efficient internal processes. They lack experience and contacts in bidding for the only local large consumer of software services, the Public Sector. The latter has its own internal software groups and staff. However, these groups' skills need to be upgraded to keep up with the new generation applications needed to produce the envisioned e-government applications by 2005. Most of the ICT firms interviewed wished to work on government ICT projects but were concerned with the project specifications being inaccurate and too simplified, as well as the sign-off and client certification processes being inexistent.

B. Policy and Regulatory Framework

Tunisia's progress in establishing a coherent policy and regulatory framework conducive to growth and employment generation in the ICT sector, has been remarkable in the past two years. The Government is currently addressing the issue of sector reform through several measures. An offer made to WTO is likely to push forward the liberalization agenda, especially in cellular and data services. In addition, a new **Communications Law** (*Code des Communications*) has been approved by Parliament. This Law will have considerable impact on sector development by addressing the following areas: sector liberalization, simplification of existing procedures to award licenses and authorization, and the creation of an independent regulatory agency. The Law has been complemented by several implementing decrees, in key areas like interconnection and rights of way. Two authorities were created for the regulation of telecommunications: *Agence Nationale Des Frequences* (under the Ministry of Communications Technology), and the *Instance Nationale des Communication*, an independent arbiter of the telecommunications sector.

The first significant tender to open up the telecommunications market is the tender for a **second GSM operator**, which is about to be concluded and solicited interest from international operators.

In addition, a competitive environment is being created in the private ISP market. Licenses for 6 **new ISPs** are being issued, ending the duopoly in the ISP market. Until recently, the private ISP market was dominated by *Planet Tunisie* et *3S Global Net* that practice similar tariffs (there are 7 other ISPs servicing the public sector). IN September 2000, ATI issued invitation to bid by new ISPs for the following regions : Béja, Sousse, Kairouan, Sfax, Gafsa et Médenine. Three licences have already been awarded to ISP for the regions of Sousse, Sfax et de Béja.

In the area of electronic commerce, the progress was also substantial. Last August, a **Law on Electronic Commerce** was enacted, making Tunisia the first North African country to approach the regulatory framework for electronic commerce in a clear and coherent framework. This Law incorporates the main principles of the UNCITRAL Model Law and relevant EU legislation. Moreover, draft Laws are in discussion in related areas, such as the recognition of electronic signature, certification, consumer protection, and privacy. A certification authority has also been established to oversee and facilitate electronic transactions. In addition, restrictions on in-house Web content development (hebergement) by enterprises, that represented an important

bottleneck to the development of e-commerce, have been removed, therefore liberalizing content development. The Government has authorized content development (arbitrer les sites) under the condition that a number of security conditions « conditions de sécurité » are respected.

The policy and regulatory framework is therefore aimed to create an adequate environment for the growth of the ICT industry. This significant progress, however, would need to be complemented by additional measures, proposed in chapter 5, in line with the ambitious ICT development objectives of the 10th Plan.

C. Government Programs

In addition to ambitious programs that the Government has started in education, scientific research, health, and agriculture (see Chapter 4) that are expected to create a large market in ICT services, the Government is putting in place supporting infrastructure (and incentives) to encourage ICT development. In this context, several projects have been launched including the Tunis Technology Park incubator projects and cyber-parks (BOX below).

Box 3.1: Tunis Communications Technology Park

The government of Tunisia is aiming to create a series of thematic poles of technology. Tunisie Télécom has been granted the responsibility for the first of these, which is the Park of Communications Technology in Tunis. The objective of the Park is to create an environment of advanced technology, similar to the best practices at Sophia-Antipolis in Nice or in the Silicon Valley, to stem the flow of qualified manpower leaving Tunisia. The underlying concept is to bring together institutions of advanced knowledge and research. The Park consists of the following institutions: the Advanced School of Communications (Supcom); the Advanced Institute of Communications Technology of Tunis (Iset'Com); the Centre for Telecommunications Studies and Research (CERT).

The first phase of the Technology Park was inaugurated at the beginning of the second semester of 1999 with a site that contained industrial module units and units of training development and recycling. Seven information and communication technology sector enterprises have already been brought in: Cynex Software, Alcatel, BFI, OmniaCom, PicoSoft, IRSIT and Archimed. This amounts to a core group of over 300 engineers and advanced technicians. Preparations for the second phase of the Park are already in the works. Furthermore, due to the numerous enterprises that have declared their intention to move to the Park, the launching date for the third phase had to be advanced. The second and third phase ought to be ready by the end of the year.

In the same context, an incubator for projects was created in the Park, in order to enable young competent nationals who are interested in investing in ITC to lead their own projects, or even possibly launch their own enterprises. The individuals selected for this opportunity are offered a office space with phone, fax and Internet access free of charge for two years. The CERT manages the projects centre. Eight projects have presently been approved, and another 20 are in the waiting. The projects in development relate to telecommunications control, telecommunications surveillance and telecommunications training. Three projects have already been launched within the centre.

Box 3.2: Project Incubators and Cyberparcs

Enterprise incubators. In February 2001, the Government of Tunisia announced that the launching of regional enterprise incubators was underway and that these would be placed under the jurisdiction of the Superior Institute of Technological Studies (ISET). Created in 1998, the ISETs are educational institutions corresponding to the college level, which educate superior technicians in telecommunications management and in Tunisian postal services. The Agency for Investment Promotion (API), subsequently announced that the first enterprise incubator would be operational in ISET-Nabeul. This incubator would consist of nine enterprises spread over an area of 400 m². The beneficiaries of this program would not be confined to graduates from the ISET-Nabeul institute. The projects admitted would be service projects of innovative nature, would employ a maximum of four people and would be allowed to reside with the ISET-Nabeul for a maximum period of two to three years. The selected enterprises would initially face substantially lowered costs, which would gradually evolve throughout the incubation period towards the market prices.

Cyberparcs. Parallel to the enterprise incubator initiative, the Tunisian government announced the creation of cyberparcs. These would be sites permitting young employees to work from a distance with companies based in the

capital, or even abroad. The first cyberparcs ought to be in service by the end of 2001. The authorities have also invited young workers to take training courses, in order to be able to join a work program at the cyberparc.

- **PC Familial:** PC penetration, at home and in the SMEs and the whole IT infrastructure, remain a bottleneck, especially due to its depressive impact on domestic demand of software and IT services. The initiative “PC familial” should be extended and strengthened, in terms of size and availability of financing. Countries such as Brazil and Egypt are also running such PC penetration programs for around \$300 to \$500 a PC, respectively. Introduction of IT in the schools might also be beneficial to generate internal demand. The SMEs are still relatively unaffected by the ICT revolution and an initiative such as the “reseau pour la PME/PMI” should also be started and subsidized by the government where a full “ICT package” (LAN, PCs, software, internet account and fixed line/mobile plus training and support) is designed by SME representatives, operated by the local private sector and promoted by the government (financing, subsidies and tax incentives).

D. Financing

Efficient capital markets and flexible financing are essential for the growth and development of ICT start ups. High-tech investment requires higher share of equity financing and adequate risk sharing mechanism, than other more traditional investments. This places Tunisia at a competitive disadvantage *vis-à-vis* some of the competitors as capital markets are biased towards loans to large firms and Government bonds. Start up companies face higher barriers for access to capital and constraint to growth potential.

The Government has recognizes the need to develop efficient mechanisms for ICT financing and has taken steps in this direction: (a) mutual funds are growing; (b) some banks and financial intermediaries expressed initial interest in venture capital activities. In addition it has established mechanisms (e.g., see Boxes below) to facilitate financing of start-ups.

BOX 3.3: FOPRODI

FOPRODI has been redesigned to support industrial projects and job creation by providing venture capital. The new FOPRODI seems promising, as 20 projects have been financed since the mid-1999 reform. Under the new scheme, FOPRODI, through SICARs (Sociétés d’Investissement en Capital Risque), privately financed closed end risk funds, participates in the equity of new companies. Eligible investments amount to up to TD 3 million (instead of TD 1 million previously) and the previous loan component is replaced by equity participation. Equity must account to at least 30% of total project cost. The balance (70%) is financed through (i) FOPRODI credits, up to 30% of total project cost; they have to be repaid over a twelve-year period and bear a 3% annual interest rate, (ii) bank loans, and (iii) State’s contribution to the purchase of industrial land and technical studies and assistance, amounting to 3.75% of total project cost.

Entrepreneur’s initial contribution to equity represents 10% of equity. To strengthen supervision and monitoring of the entrepreneur’s activities, the contribution (45% of equity) will be managed by the SICAR during project implementation rather than being immediately granted to the entrepreneur. In addition, this contribution is expected to be reimbursed by the entrepreneur after a given period of time, thus allowing financial sustainability of the facility. To avoid misuse of funds, the SICAR itself has to invest out of its own resources 45% of equity. This contribution also has to be repaid by the entrepreneur over a 12-year period, at a price contractually agreed upon at the project launching date. This mechanism is therefore closer to a participatory credit scheme than to venture capital.

In this new scheme, the SICAR will hold 90% of equity during the first phase and will thus bring its

expertise to project design and implementation. The entrepreneur will then be enabled to manage the FOPRODI contribution and will therefore hold 55% of equity. Hence the SICAR will keep sufficient equity participation to be involved in project management until the entrepreneur is able to reimburse its contribution.

Future performance of FOPRODI will thus heavily depend on how SICARs will be managed.

FITI - Fonds d'Incitation à l'Innovation dans les Technologies de l'Information

The government created the FITI in February 1999 to support small scale investments by the private sector in information technologies. The government will co-finance up to 49% or a maximum of TD 200,000 of information technology projects if the following conditions are met: (a) the project is approved by and presented to FITI by a venture capital firm (SICAR), and the SICAR commits to provide at least 30% of the start up capital of the project; (b) the investor provides at least 2% of the start up capital; and (c) FITI's cofinancing is not higher than the share of the SICAR in the start up capital.

However, several firms underlined capital markets constraints. Small high tech firms are lamenting the fact that banks do not provide credit for start up activities and new ventures need to be financed by own funds. Long term credit seems to be extended mainly to large enterprises in traditional sectors. Venture capital is virtually absent.

In general, some elements of Tunisian capital markets are not conducive to financing new technology start ups. Among these: (a) strong orientation of capital fluxes towards bonds; (b) underdevelopment of the Stock Exchange; (c) absence of a 'Secondary Market' (NASDAQ model), to list small IT enterprises; (d) underdevelopment of a corporate bond marketⁱⁱ.

The introduction of a secondary market for small caps might not be enough to overcome the several constraints present in Tunisian capital markets with respect to funding new technology. In this respect, a stronger role can be played, in the short-medium term, by Private Equities Funds (closed funds), that can invest in private high technology firms and accompany their development towards stock market flotation.

Venture Capital funding is different from traditional sources of financing. Venture capitalists finance innovation and ideas which have potential for high growth but also have inherent uncertainties. This makes it a high-risk, high return investment. In addition to finance, venture capitalists provide networking, management and marketing support. In the broadest sense, therefore, venture capital conreports risk finance as well as managerial support. In the global venture capital industry, investors and investee firms work together closely in an enabling environment that allows entrepreneurs to focus on value creating ideas and venture capitalists to drive the industry through ownership of the levers of control in return for the provision of capital, skills, information and complementary resources. This very blend of risk financing and hand holding of entrepreneurs by venture capitalists creates an environment particularly suitable for ICT enterprises.

Generally, equity markets are a more appropriate source of financing for new ICT enterprises in comparison to more traditional sources, taken into consideration the enterprises' limited amount of capital, their lack of guarantees and the perception of risk involved. Tunisia has 25 SICARs, however they rarely invest in ICT projects due to a lack of expertise in evaluating these. One SICAR (TUNIVEST) recently launched a new ICT venture capital¹⁷, and has begun reinforcing its

¹⁷ Partners in this initiative are: (a) Ministry of Communication (Tunisie Telecom): 10%; (b) Tunisian banks and private companies: 30%; (c) European community fund: 40%; and (d) European investment bank and other organizations: 20%.

internal technical capacity in evaluating ICT start-ups by recruiting an ICT specialist. Thus, investment activities in the Tunisian ICT sector ought to be intensifying in the near future. However, this is contingent upon the expertise spreading more rapidly amongst the SICARs, in order to reinforce the overall capacity to evaluate ICT projects. Other necessary measures to improve the financing of ICT start-ups include: the development of an IPO (Initial Public Offering) and mergers and acquisitions market; and incitements for institutional investors (insurance companies and pension funds) to invest their funds in projects with a certain amount of risk involved.

Critical Factors for Success of Venture Capital Industry in Tunisia include:

- The regulatory, tax and legal environment should play an enabling role. This also underscores the facilitating and promotional role of regulation. Internationally, venture funds have evolved in an atmosphere of structural flexibility, fiscal neutrality and operational adaptability. Regulatory simplicity and structural flexibility should be provided on the same lines. There is also the need for a level playing field between domestic and offshore venture capital investors.
- Investment, management and exit should provide flexibility to suit the business requirements and should also be driven by global trends. Venture capital investments have typically come from high net worth individuals who have risk taking capacity. Since high risk is involved in venture financing, venture investors globally seek investment and exit on very flexible terms, which provides them with certain levels of protection. Such exit should be possible through IPOs and mergers/acquisitions on a global basis—including acquisitions by foreign investors. But regulations that involve government approval of domestic firms' acquisitions by foreign investors may increase investor uncertainty and impede the design of efficient exit strategies. This may limit the supply of venture capital for high technology local start ups.
- Venture capital should become an institutionalized industry financed and managed by successful entrepreneurs, professional and sophisticated investors. Globally, venture capitalist are not merely finance providers but are also closely involved with the business start ups and provide expertise by way of management and marketing support. This industry has developed its own ethos and culture. Venture capital has only one common aspect that cuts across geography i.e. it is risk capital invested by experts in the field. It is important that venture capital in Tunisia be allowed to develop via professional and institutional management.

E. Human Resource Development

At present, Tunisia generates 12,500 jobs in the ICT sector, of which some 7,000 are employed by the Public Sector (hence the ratio of ICT jobs for the whole working population is 1/300, a very low number compared to other countries, such as Croatia or Malaysia where the ratio is more than 1/100. Up to 2006, the aim is to generate 25 percent of all new jobs in the ICT sector ; this means annual employment creation of 20,000 in the ICT sector to meet the government objectives in the next four years. Given Tunisia's strengths and capabilities, as well as its commitment to sweeping sector reforms, this target seems achievable.¹⁸

¹⁸ Tunisia has a young population, mostly bi-lingual, (Arabic and French) or tri-lingual (in addition to Arabic and French, Italian, English or Spanish is often a third language). Tunisia's geographical location between Europe, Africa and the Middle East, and the Association Agreement with the European Union allows Tunisia easy access to important markets. Education is very high on the Government's agenda. In fact, 30% of the government's annual budget goes to the Education Ministry. Tunisia's primary/secondary education enrollment ratio of 91 percent is the highest in MENA. Girls and Boys enrolment is the same, unlike many other MENA countries where young girl's enrolment is substantially lower

Tunisia currently has a shortage of skilled ICT labor force of 2000 people and unlike other countries with a surplus of ICT workers (India, Lebanon, Jordan, etc.); it has to build-up this capacity as it is starting an ICT sector expansion strategy. On the positive side, this implies there is room for substantial growth, and that the year 2005 objective of 25% new jobs in ICT sector alone could be possible.

India - Massive Deployments of Training Centers

Tata Infotech's Education Division is setting up a **chain of over 200 exclusive education centers** across India to offer professional courses under an umbrella called "Ambition." Ambition is targeted at helping professionals upgrade their skills to the latest technologie in 35 metro cities and 100 non-metros in the country. Tata Infotech Education plans to invest around \$10.87 million in the next two years on education-related activities in India. By the end of the 2002, the company proposes to train more than 25,000 professionals through its centers. The courses under Ambition range from introductory to advanced and value-added ICT courses. The courses include computer-based training delivered in association with Smartforce (U.S)

Computer education major NIIT Ltd. will set up 1,000 more education centers by 2002, as part of its strategy to achieve a leadership position in IT education and training by the year 2004. NIIT now has 2,000 centers all over the world providing computer education in 26 countries including China, Indonesia, Malaysia, South Africa, and the US.

NIIT just signed a memorandum of understanding (MoU) with The Infocomm Development Authority of Singapore to recruit 1,000 qualified talent from the latter's training centers in India, China, Indonesia and Malaysia.

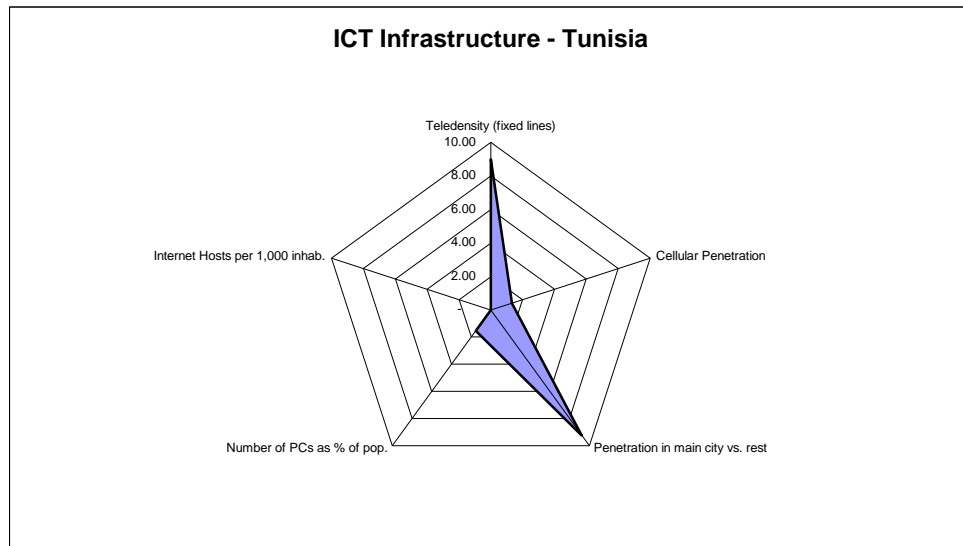
F. Telecommunications and Information Infrastructure

The status of development of the information infrastructure is a key indicator for the growth potential of ICT services in a country. The analysis points to key bottlenecks to growth and areas where public policy and regulatory reform needs to focus on. The performance of Tunisia in the development of a high quality-low cost information infrastructure is benchmarked against the performance of a sample of 11 countries. Some of these are recognized global performers in the development of ICT services (such as Chile, Malaysia, India, Ireland and Israel). Others are potential regional competitors to Tunisia in the offer of ICT services (such as Morocco, Egypt, Turkey and U.A.E.), while the rest are global competitors (Latvia and Malaysia). The analysis of the information infrastructure takes into consideration the fact that income differentials influence many of these variables, and therefore, the choice of benchmarks includes countries from all classes of income. In particular, 5 benchmarks were chosen among countries of the same class of income as Tunisia (Lower Middle). One country was selected among Low Income countries, India, but the analysis considers the status of the information infrastructure in Bangalore and other high tech district, rather than the whole of India. Three countries were chosen among Upper Middle Income and two from High Income countries.

The benchmarking analysis has been conducted in the following main areas, each of which represents and important dimension of the information infrastructure: (a) telecommunications

than that of young boys. Tunisia's universities and public school systems have a very good reputation. Tunisia has a high tertiary education enrollment ratio, as 22% of Tunisia's population of young adults (19-24 year old) is currently enrolled in some superior or vocational training program. In the ICT sector, seven public institutes and 150 private schools were recently launched to teach office automation and management information systems. Despite these, the demand for ICT skills still exceeds the supply.

network development; (b) access to communications; (c) mobility; (d) IT infrastructure; and (e) Internet infrastructure. The indicator “Telecommunications Network Development” includes indicators on the development status of the basic telecommunications infrastructure in Tunisia, compared with the benchmarks countries, with particular attention to variables indicating network size, quality and efficiency. “Access to Communications” presents indicators on the level and evenness of the diffusion of communications services in different geographical areas within the countries included in the sample. “Mobility” indicators monitor the development of wireless communications technologies across the countries. “IT Infrastructure” presents indicators on the degree of penetration of Information Technologies, such as PCs. “Internet Infrastructure” presents data that allow to determine the development of the Internet in the countries of the sample (see figure below).



Source: International Telecommunications Union, World Bank, Global Mobile, Network Wizards.

The benchmarking of the information infrastructure in Tunisia with other similar countries reveals that the balanced development of the basic network, and the specific initiatives of Tunisie Telecom, to bring broadband access outside the main cities means that Tunisia has the possibility to **promote the development of IT services, teleservices and call centers outside of the main cities**, therefore exploiting competitive advantages and enhancing job creation. However, to achieve the ICT growth and employment objectives of the 10th Plan, broadband must significantly increase (see Chapter 5).

The benchmarking of the information infrastructure in Tunisia with other similar countries reveals that:

- The fixed line network is well developed and efficient. Strategic attention should be paid to **enhance revenues generation from the existing network**. This involves to promote advanced telecommunications-related services under private sector leadership and extension of competition among service providers.
- The balanced development of the basic network, and the specific initiatives of Tunisie Telecom, to bring broadband access outside the main cities means that Tunisia has the possibility to **promote the development of IT services, teleservices and call centers outside of the main cities**, therefore exploiting competitive advantages and enhancing job creation .

- **Internet, data and wireless infrastructure shows room for growth**, and at the moment they are one of the most important bottleneck to the implementation of the Government objective to bring ICT services to 8% of GDP. In a well performing telecommunications sector, revenues from wireless and data now exceed revenues from fixed line voice services, bringing telecommunications revenues to over 4% of GDP. This is not the case in Tunisia, where telecommunications revenues from services are about 2.1% of GDP, and mainly concentrated into voice services. The policy effort of the Ministry of Communications, towards more competition and private participation in these areas, should be encouraged and strengthened (see section on policy and regulatory framework). A second reason for the importance of developing wireless and data infrastructure, aside from the possibility of having a quick expansion of telecommunications revenues, is its positive spillovers on other ICT segments, such as IT services, advanced media services and e-commerce, in both rural and urban areas.
- **PC penetration, at home and in SMEs remain a bottleneck**, especially due to its depressive impact on domestic demand of software and IT services. The initiative “PC familial” should be extended and strengthened, in terms of size and availability of financing . Countries such as Brazil and Egypt are also running such PC penetration programs for around \$300 to \$500 a PC, respectively. Introduction of IT in the schools might also be beneficial to generate internal demand. The SMEs are still relatively unaffected by the ICT revolution and an initiative such as the “reseau pour la PME/PMI” should also be started and subsidized by the government where a full “ICT package” (LAN, PCs, software, internet account and fixed line/mobile plus training and support) is designed by SME representatives, operated by the local private sector and promoted by the government (financing, subsidies and tax incentives).

While benchmarking Tunisia with other competitors shows that mobile and Internet are the two areas of delay in the development of the information infrastructure, the real bottleneck to ICT sector development is bandwidth.

When Tunisia is going towards an information society, its telecommunications and networking infrastructure has to support the development. It means that all parts of the network – access, regional backbones, national backbone and international interconnections – have to be upgraded to meet the bandwidth requirements of new applications. Bandwidth needs of some common new era services are presented in the following figure.

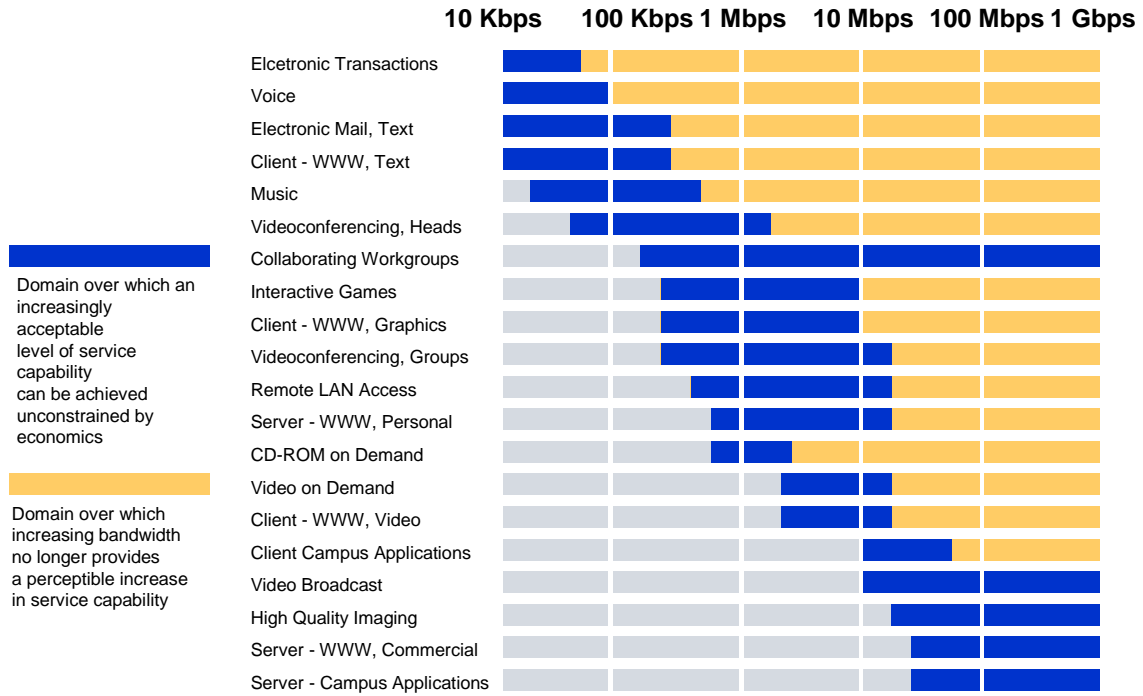
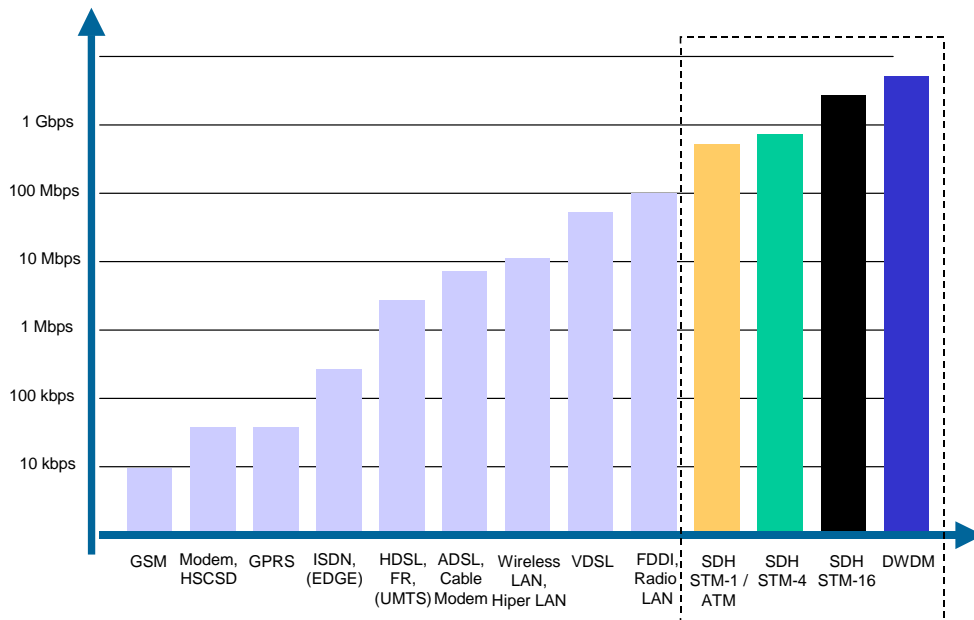


Figure 1 Bandwidth demand of different services (notice logarithmic scale)

When the need of bandwidth and the number of customers are combined in the network planning phase, the total bandwidth can be estimated and implementation technology can be selected. The bandwidth offered today by different technologies is shown in the following figure. The state of the art technologies for backbones are the four last ones: SDH for basic transmission system and DWDM when the bandwidth of the physical optical fiber core needs to be expanded



heavily.

Figure 2 Bandwidth supply of different technologies (notice logarithmic scale)

The backbone network of Tunisie Telecom is build using SDH technology. This technology selection is optimal, since it allows fast capacity enlargements in the network. The Tunisian backbone consists of 622 Mbit/s STM-4 national backbone ring of seven major cities and 55 regional 155 Mbit/s STM-1 rings, which are connected to the national STM-4 backbone. These are the transmission system speeds that are used at the moment. However, the installed rings themselves can transmit traffic up to tens of Gbit/s. International transmission system shall be expanded to STM-1 155 Mbit/s level this year. Again, the installed international connections can transmit up to 850 Mbit/s when transmission systems are updated. The backbone logic is presented in the following figure. The backbone structure in Finland used to be similar in 1996. Today the three independent (competing) Finnish backbone networks each consist of a 2,5 Gbit/s STM-16 nation level backbone (in a 5 Gbit/s DWDM core) and of STM-4 regional networks connecting STM-1 rings together. Tunisian backbone is expected to be similar from capacity and technology point of view in less than five years.

A typical Finnish operator network structure is described in more detail in the following figure. The STM-16 core is connecting the biggest cities and STM-4 rings are connecting other university and major cities to this core. Connections to transmission services' customers – i.e. to access level – are provided via STM-1 loops. These “collecting” networks are called Metropolitan Area Networks. Some major customers can, however, be connected directly to the STM-16 core.

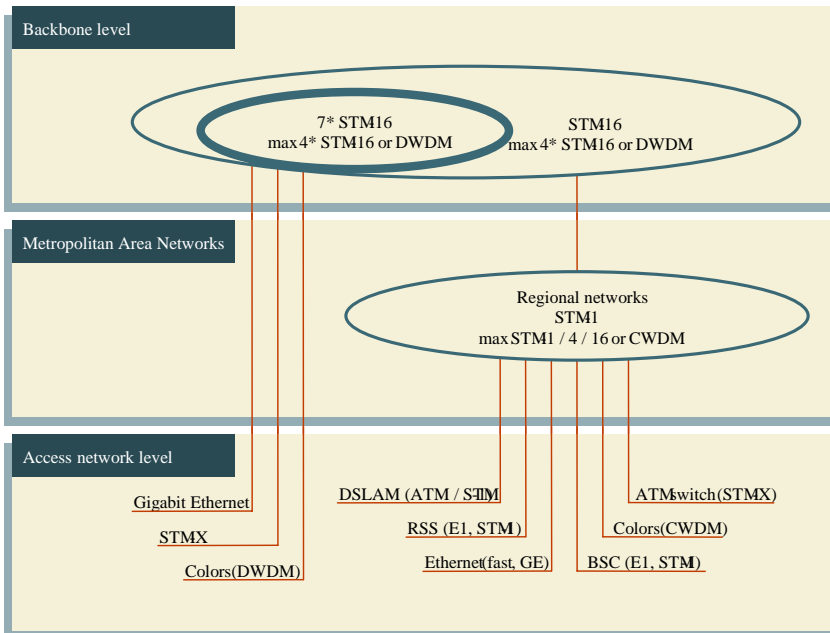


Figure 3 Finnish transmission and Metropolitan Area Network structure

In access network, Tunisian telecommunications companies have to provide new broadband access solutions to end-users e.g. new Digital Subscriber Line (xDSL) technologies, fast-Ethernet solutions and wireless technologies. xDSL and ATM solutions are already being introduced by Tunisie Telecom.

The international Internet interconnection capacity is now 81,5 Mbit/s in Tunisia. It will be upgraded to 155 Mbit/s during this year. This is reasonable bandwidth for the needs today. However, the international interconnection has to support up to Gbit/s level bandwidth for the future needs. The bottleneck in Tunisian international interconnections is the Internet gateway that delays the traffic. This delaying feature in the gateway has to be removed and several parallel international gateways have to be introduced.

Competition speeds up the development of telecom infrastructure and it has a positive impact on Quality-of-Service and end-user prices. When introducing the competition, the telecom infrastructure should be studied in four layers of business and players: The following figure presents the four layers of new era telecom business.

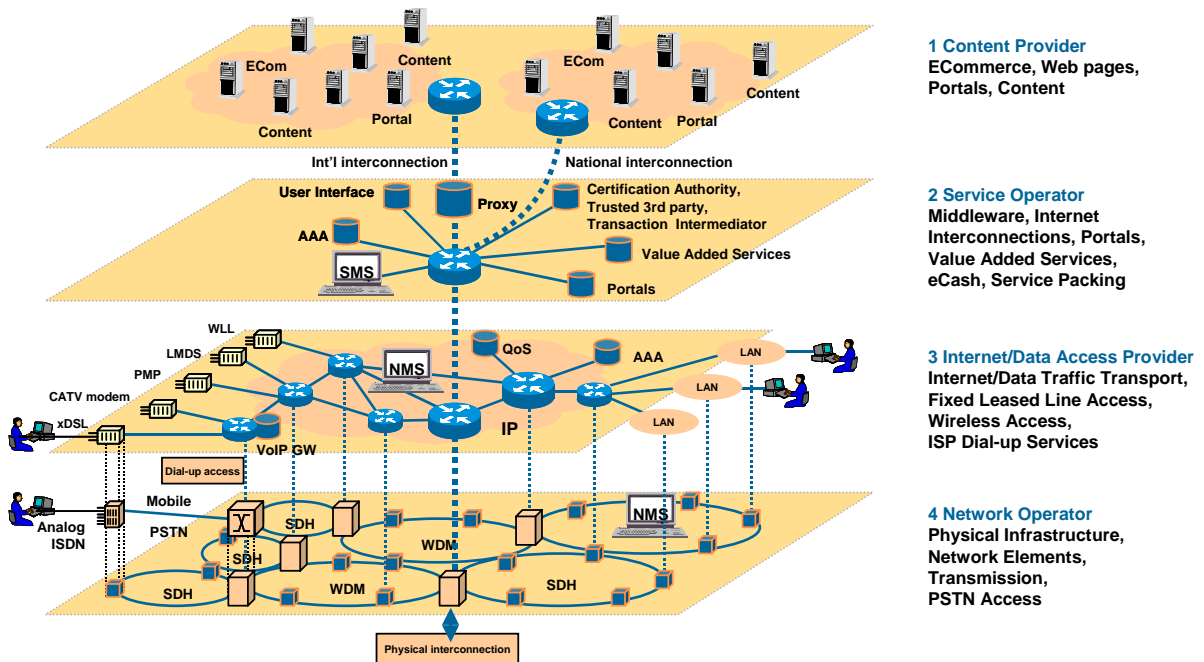


Figure 4 New era telecom business levels from infrastructure point-of-view

Telecom business companies may have four roles:

- Network Operator providing the physical connections, basic telephony, and transmission;
- Access Provider serving the customer with the new era LAN access solutions, and transporting the Internet and data traffic;
- Service Operator offering the basic services that a user needs, and providing value added services and international as well as national interconnections to other networks;
- Content Provider being the far-end of communication offering the content that a user demands.

The competition should be introduced to all levels of business. The four levels and the players should be studied separately for licensing. Concurrently with the upgrading of network infrastructure, emphasis should be put especially on the development and restructuring of the two upper business layer. This is a task that requires not only ICT industry but also other lines of business.

IV. Opportunities for ICT Development

A. Introduction

In addition to policy steps to liberalize the ICT industry, Tunisia possesses important assets for ICT development that distinguish it from most of its competitors. First, it has a strategic geographical position close to the EU, African and Middle Eastern markets. Second, its population is young and well-educated that could represent a reservoir of strength compared to European countries with aging populations. Third, it has developed a good fixed line and a growing mobile telecommunications infrastructure. Fourth, Tunisia has already an established 'export culture', which will facilitate the development of advanced ICT services tailored to the international markets. In addition, the direction of economic policy in Tunisia has consistently been toward liberalization and opening towards Europe and other regions; this liberalization has also involved the telecom sector.

These assets have already led to important roadways in ICT industry development in Tunisia and have set the stage for a comprehensive ICT drive. Several well-structured enterprises have emerged in different segments of the ICT industry. Examples are Omnicom (wireless in the local loop equipment), Alis computer (computer equipment hardware), Sotel and Netcom (networking services), BFI and SPG (value-added software services). Tunisia is also showing potential as a regional hub for multinational enterprises in the ICT industry. Examples are Nortel, Canal Horizon, and Siemens. In addition, Tunisia is progressively showing that its ICT industry could serve as a platform for delocalization of European software and IT-enabled service enterprises. Examples are Alcatel (software and networking), and @home (e-commerce).

To realize its ambitious objectives for the development of the ICT sector, Tunisia could build on these assets and take advantage of the global demand for ICT services and position itself in a number of sectors that present a significant opportunity for Tunisia. It could also develop the local demand for ICT services, stemming from the Government, enterprises and households. Tunisia would also reap substantial macroeconomic benefits from ICT development, as the ICT sector would become a driver of faster growth and employment generation for the economy as a whole. This section discusses these opportunities.

B. Drivers of ICT market development

ICT development could be based on opportunities in both the external and internal markets. The rapid growth and dynamism of the global ICT industry and the resulting opportunities created for countries to position themselves in the global marketplace, despite the recent slowdown. But the domestic market will also create momentum for ICT development. The areas that present the highest potential for Tunisia and where growth will be initially driven by foreign demand are: (a) value-added software services; (b) IT-enabled services; and (c) advanced media services. To a lesser extent, Tunisia could also position itself in telecommunications and networking services. But telecommunications services will be primarily developed in the local market by building on the existing network and telecom infrastructure. Growth in the mobile network will be a main driver of growth, as there is considerable pent up demand which creates large room for growth.

There could be significant opportunities in the local Tunisian market for all the above services. In effect, much potential remains for the application of ICT services in the Administration, private

enterprises and households, in comparison with the levels achieved in other emerging economies. The expenditures of the Administration and the private sector on ICT services today represents less than 1% of GDP compared to between 2% to 3% in OECD countries.

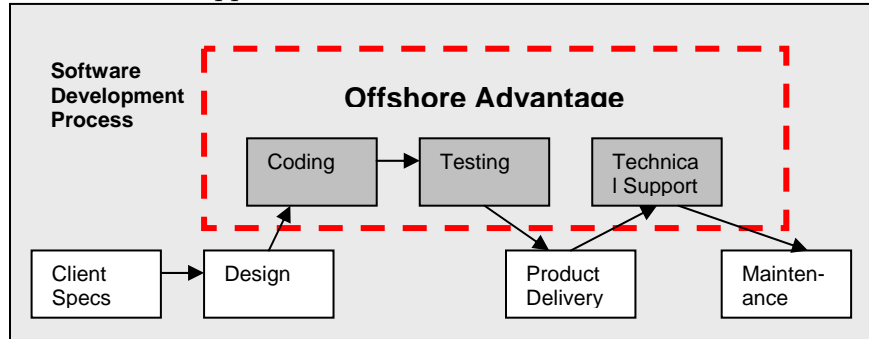
C. Growth opportunities in segments of the ICT Industry

a. Software and software Services

Drivers of market growth. There are two drivers for software and IT applications development. The domestic market and the world market. The world market is growing fast. Despite the current slowdown, the US\$410 billion global software industry is projected to continue to grow at 15% per year for the next five years. The domestic market has good prospects because it is untapped and the Tunisian economy is growing fast, but it is too narrow to support a boom of the sector in the short term. Thus export growth will be the main driving force in the next few years.

Successful exporters of software and IT applications services have followed different routes. But there are two main exporting models.

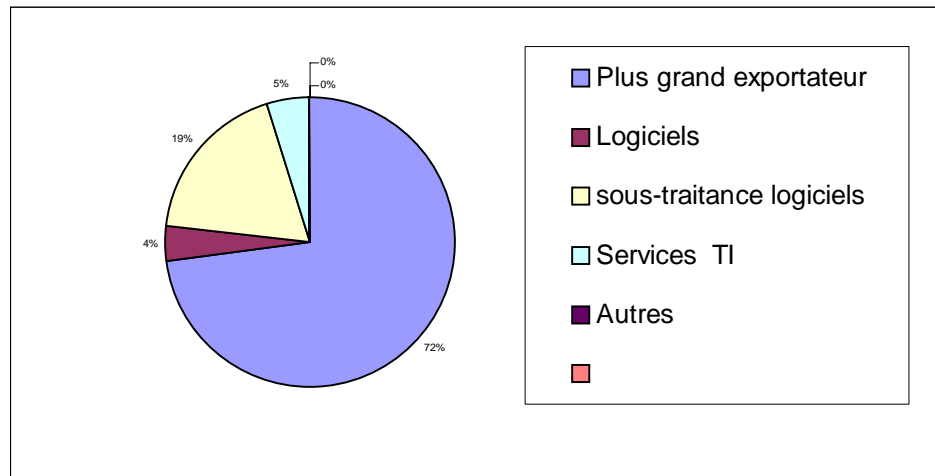
One is the model followed by countries such as Ireland, Malaysia, Dubai, UAE (Box X). These countries have become hi-tech hubs by attracting massively the largest



players in the ICT industry. Companies such as Microsoft, IBM, Cisco, Oracle established regional offices and production facilities in these countries, which become platforms for worldwide software exports. [Main competitive advantages of these hi-tech hubs included a highly skilled workforce; a favorable business climate with specific incentives to ICT investors; close links to the English-speaking business community.] The entry of foreign IT companies also gave a boost to home-grown software developers.

The other is the model followed by countries such as India, Philippines, and Pakistan. These countries have seen booming exports of software based on outsourcing work from global ICT industry players. This outsourcing model is depicted in the graphic. These countries have developed an advantage in providing coding, testing and technical support services, which are labor-intensive and very cost-sensitive. The main factor of this competitive advantage has been a surplus of inexpensive and highly qualified engineers.

Potential for Tunisia. In Tunisia, software export activity is still limited. Based on the survey of IT companies that covers about 80 per cent of software and IT applications sales (section 3), Tunisian exports in 2000 were about TDN 16.5 million. The majority of these exports, about 80 per cent, are concentrated on packaged software and higher end custom solutions, with the rest being outsourcing. But, exports of software are dominated by only one high-flyer company, which represents about 75 per cent of total exports (figure).



Exports of other Tunisian software firms, are concentrated on outsourcing, at more than 80 per cent. Those companies outsource work from European firms implementing contracts globally, based upon traditional business and personal networking.

But the outsourcing segment of the market may not be a sustainable model for the Tunisian software industry, especially for smaller firms that are working on a contract basis.¹⁹ Tunisia does not possess the surplus skilled labor of major market leaders in outsourcing, while these countries entered the global market much earlier. In addition, other factors that are eroding competitiveness of purely offshore programming operations include:

- Increasing competition in traditional (EU) markets from lower cost producers. Tunisian companies face rising competition from Eastern European, Indian, South African and MENA firms, even in French markets.²⁰
- Limited capabilities of most Tunisian firms. Because of the cost of acquiring software engineering tools, lack of government support, and an orientation to less demanding African markets, most Tunisian firms lack international quality certification, essential to compete in global markets. In contrast, over half of SEI-CMM 4 and 5 certified companies worldwide (150) are large Indian firms.
- Limited scale and capacity of most Tunisian firms. Most Tunisian firms are small and lack the scale to handle larger contract programming jobs.
- Insufficient critical skills. The external market perception is that Tunisia has good software technical staff, but lack critical skills in small ICT firms' employees to acquire entrepreneurship, marketing, presentation and management skills.

¹⁹ Significant expansion of this purely cost- and subcontract-based outsourcing model is difficult, at least directed at traditional EU markets. Additional growth may be possible by linking up with Indian software firms that are providing more sophisticated services and may look to outsource segments of the market, particularly for French language markets (One of the largest MNC Indian firms, Infosys, has just entered into a variety of collaborations in Morocco for the French market). Scope also exists to diversify away from Europe to target West and Central African and other regional markets. A number of Tunisian software firms have been successful in doing turnkey projects in these countries, where they have linguistic and technological advantages.

²⁰ These competitors offer significantly lower labor costs—wages for programmers with 5 years of experience in Tunisia are about US\$100/day compared to about US\$20/day in India and US\$40/day in Russia, at same or better quality levels and turnaround times.

Table 3—Moving Up the Value Chain Requires Development of New Competencies (potentially interesting but hard to understand—again, for the non specialist)

Client Requirement	Offshore Business Activity	Firm Skill Requirement
Staff augmentation	Coding, Testing, Maintenance	Technical skills
Turnkey projects	Project implementation	Software project management; software design
Automation of business processes	Package implementation	Project management Functional understanding
Convergence of systems & business processes	System integration	IT architecture development
Assessment of future trends & impacts	IT-led business strategy	Business modeling Process reengineering
Evaluation of business model	Business strategy	In-depth domain knowledge

Source: Infosys

The long-term sustainability for the Tunisian software sector is to “move up” the **software value chain**. In terms of software outsourcing, this means a move away from low-end coding, testing and maintenance operations to conceptualization, architecture, systems design, business process automation and systems integration work. These are higher margin and more stable activities. This also implies some M&A in the Tunisia ICT market to gain scale and size advantages when competing for international clients.

Tunisia thus should aim to become a hub for software development and services by attracting foreign software firms and promoting partnerships of those firms with domestic software development companies. Tunisian firms should also engage in development of **customized software packages or solutions**. A leading example of this in Tunisia is **BFI**, which is providing a range of solutions for financial and related industries globally and in the MENA region.

Software development firms should also concentrate on the most promising **vertical markets**, where customization of existing packaged solution is needed and is very expensive due to a shortage of skilled experts. Globally, the trend is toward web-based, e-business software systems such as Customer Relationship Management (CRM), Application Service Provider (ASP), Enterprise Resource Planning (ERP) solutions for the financial, telecommunications, education and training, retail and manufacturing industries. Major development opportunities also lie in systems integration and convergence activities and software customization and localization. If the right enabling environment is set in place, the contribution of packaged software and services to the total ICT sector growth might rise to 12% of total sector revenues by 2005, or US\$ 300 M.

What impact on employment and revenue growth? Total revenues of the software and software services in Tunisia is now estimated at about \$ 30 million. With a fast projected increase in software exports, revenue in 2005 would be about ten times as high, while employment in that segment would reach about 5,000 persons. Software and services would thus represent about 12 per cent of the Tunisian ICT sector in 2005.

	2000		2005	
	Revenues (\$M)	Total Workforce	Revenues (\$M)	Total Workforce
Software and Software services	50	500	300	5000

b. IT-enabled Services

Drivers of Market Growth. Worldwide, the IT-enabled service industry is growing much faster than the software industry; growth of the industry continues even in the context of the recent economic downturn, which is leading to a slow-down in the software services industry (Table 4). It therefore seems that in IT-enabled services sector, the world market would be the main driver.

Table 4 – Global Market for ICT-enabled Services (US\$B)

Sub-Segment	1998	2008	CAGR
Customer services	\$6.5	\$33.0	18%
Finance & accounting	\$1.5	\$15.0	26%
Translation and transcription	\$1.3	\$20.0	4%
Engineering & design	\$0.3	\$1.2	21%
Human resource services	\$0.4	\$5.0	29%
Data search, integration and management	\$0.2	\$44.0	71%
Remote education	--	\$18.0	--
Consulting	--	\$15.0	--
Web site services	--	\$5.0	--
Market research	--	\$3.0	--
Total	\$10.0	\$142.0	30%

The ICT-enabled services is a relatively new segment of the ICT industry. Its impressive growth benefited largely from the recent downsizing and outsourcing trends in government and private sector. It also benefited from global Telecom infrastructure expansion and price drops, as these two factors were key drivers to the creation of a virtual work environment, the basic principle behind ICT-enabled services.

Source: NASSCOM McKinsey, IT Strategies, 1999

Potential for Tunisia. There are few ICT-enabled activities in Tunisia with the exception of a large call center for a French Company (employing 300 people), a data processing center for a British healthcare firm (employing 80 people), and a few call centers servicing local companies, and employing around 30 people for the local market. The whole segment employs around 500 people currently, and is mostly export-based. It makes for around 1% of total revenues of the ICT sector in Tunisia. However, there is room for growth, especially in the global multinationals. These are constantly looking at cost-cutting methods by outsourcing off-shore customer service and data processing operations.

Tunisia has a number of important advantages necessary for certain types of ICT-enabled services, as illustrated in table 5 below.

- a) Geographical location, closeness to Europe and to Arab nations, with a highly developed tourist sector that could be used as a marketing channel for the services availability.
- b) Availability of a highly educated and multilingual workforce. There is an abundance of Arab and French and skills and some English, Italian and German skills. There are relatively abundant secretarial, administrative and communication skills, excellent for customer services operations. Tunisian labor is also suited towards sophisticated operations such as customer service management, healthcare data entry applications (medical transcriptions of patients records, etc.) Medical and legal talent to support medical transcription or deposition summary may be tapped on amongst the unemployed young health, chemistry, or medical experts, for instance.
- c) Availability of some international communication infrastructure, although ICT-enabled companies need cheap, available, international bandwidth to carry large amounts of data

and voice (such as medical transcriptions dictated over the phone and sent as a voice file to the call center), to be attractive to customers.

- d) Time zone consideration give Tunisia a very good advantage to service the European and Arab customers (as opposed to Asia based competitors)

Impact. There is a great potential for the ICT-enabled sector in Tunisia, as it usually employs several hundred people for the major call centers and customer service centers.

Attracting just a few large companies to outsource their customer services operations to Tunisian firms could generate several hundreds and even thousand jobs and employ several of the educated unemployed young Tunisians.

c. Advanced Media Services

Drivers of Market Growth. The demand of advanced media services is **domestic as far as pay television is concerned**, and **external as concerns digital content development**. The strategic interest for Tunisian firms to enter into this new market segment is due to the high value generation of the advanced media industry on a global scale. This market segment in Tunisia is almost at ground zero today, and although it will grow considerably, it will not reach in 2005 the size of other segments such as Telecoms and networking services

- Technological advances including convergence of broadcast media and the Internet are creating enormous opportunities for Tunisia in **content development, eLearning** and related activities. The Internet content market alone is estimated at US\$25 billion in annual revenues, and expected to reach US\$100 billion by 2005. Tunisian firms could capture 0.1% of the Internet Content development market, potentially generating turnover in excess of US\$100 million and 10,000 new jobs in four years.
- **Animation** is another rapidly growing market segment. Global animation revenues are estimated at US\$16 billion, and projected to grow to US\$50 billion by 2005.

Opportunities abound also in the area of **Streaming Media/Broadband**, offering significant scope for content development and multimedia. The growth of the World Wide Web and the convergence of broadcast and Internet technologies are creating a major market for streaming audio, video, text, animation and other media content.

Potential for Tunisia. The scope for Tunisia to target and exploit these opportunities is supported by a number of key factors:

- **European firms are increasing the trend towards development of regional content in MENA.** Examples of these trends are the expanded presence of the Vivendi Group in the region, through the expansion of the Canal Horizon offer, and joint investments of the group in communications and multi-media. RAI has also recently launched a channel of regional interest. These are important elements, since the development of advanced media firms is based on the strengthening on intra-industry relationships with clustered media enterprises.
- **Favorable human capital endowments:** Tunisia has a good educational tradition of Humanities, and Liberal Arts. If this human capital is trained to match the needs of multimedia industry it could constitute a good labor base for Tunisia to enter the multimedia authoring segment and to attract international media companies involved in content creation in the region.
- **Emerging domestic multi-media scene**, including advertising, TV programs, etc., which can be a good springboard to development of electronic content and Internet media.
- **There is underdevelopment of hosting and web content creation** activities in the MNA region.

Table 5-Potential Areas of Competitive Advantage	
IT Services Activity	Tunisia's Short-Term Potential
Data Conversion	
Data entry/key punching	Low , extremely cost-sensitive
Medical transcription	Low , no unique advantage, cost sensitive
Deposition summary	Low , no unique advantage, cost sensitive
GIS/Digitizing	High , availability of low cost skilled labor
Imaging	Medium , good market prospects, but significant competition
Database management	Medium , good market prospects, but significant competition
Data warehousing/mining	Medium , good market prospects, but significant competition
Voice Operations	
Reservation centers	High , multi-lingual skills, good market potential, but competitive
Customer support	High , multi-lingual skills, good market potential, but competitive
Insurance claims	Low , need better quality & brand
Telemarketing	Low , limited European market potential
Back Office Services	Low to medium in short run; high competition in US market, lack of business model in EU
Professional Services	
Engineering	High , especially for French language market
Research	Medium for French language market
Education, training	High for regional markets

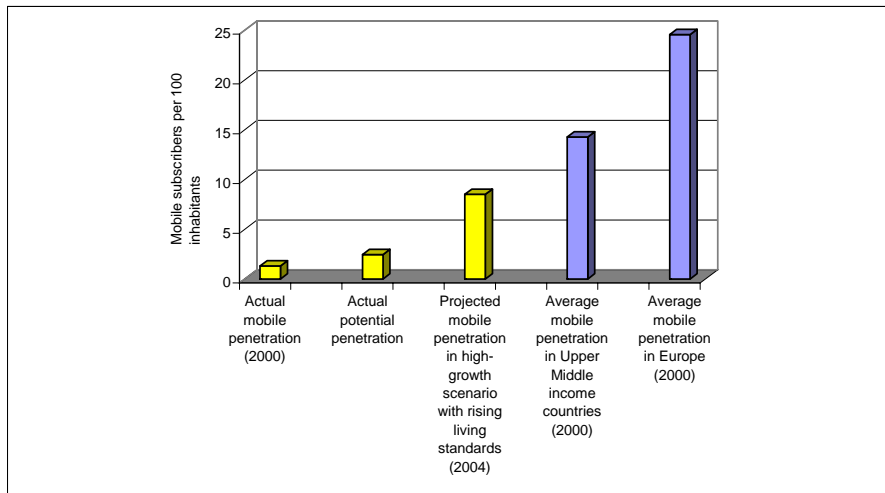
Impact. The impact of development of the advanced media industry can create revenues in the order of US\$ M 120, if a strong positioning of Tunisia as a hub for content development is de XX

d. Telecommunications and Networking Services

Drivers of Market Growth. The strong growth in revenues in the telecommunications and networking industry, witnessed on a global scale, shows an high growth potential for Tunisia, at least initially based on the opportunities in the local market. Developing countries (Estonia, Costa Rica, Morocco, Malaysia, Sri Lanka), and emerging markets that implemented an adequate package of reforms and structural changes, doubled telecommunications revenues and employment in a three-four years period, comparable to the time horizon considered by our strategy. The strong growth in telecommunications revenues, described in section 2 of the report, did not yet materialize in Tunisia. The Tunisian networking industry also did not enjoy the same expansion pattern experienced by other countries.

Growth in the mobile network is projected to be the most dynamic factor. Cross country evidence suggests that if Tunisia were to embark on an ambitious competitive opening policy option, mobile phone penetration could increase to about 7 per cent of inhabitants, up from 1.3 per cent now. And because of the high income elasticity (of around 1.6) of mobile phone demand, improvement in living standards would further boost mobile phone penetration to around 8.5 per cent (see Annex 1). Thus, in a relatively short period of time, Tunisia could have its mobile network considerably expand, to match levels seen in upper middle income countries, such as Brazil and Mexico. Moreover, much room for growth will remain beyond the projection period, along with economic development, as mobile penetration in Tunisia will still remain below average levels seen in upper middle income countries (Figure).

Mobile penetration is projected to increase sharply



Source: World Bank staff estimates, based on data from Global Mobile and ITU.

Demand in telecommunications and networking services will be primarily driven in the short medium term by **internal demand**, (corporate and household segments). Towards the end of the time horizon, **a potential for developing export-oriented activities might emerge**, especially in the provision of networking services to European markets, and development of services and applications in the wireless and data industry.

Opportunities for Tunisia. Tunisia has already developed the basis to build on and benefit from a number of opportunities in this sector:

- An extended fixed line telecommunications infrastructure is already in place, through a well extended network by Tunisie Telecom. This offers the opportunity to **enhance revenues from the existing network**, while continuing the expansion of the existing network.
- There is a high potential to **develop internal demand for wireless and data services**, presently unexploited.
- The Government is **strongly committed to sector reform**, through sector liberalization and establishment of an adequate regulatory framework for the sector.
- Tunisia, with the privatization of Sotetel, was an early mover in developing private sector providers of networking solutions for the telecommunications infrastructure. The local networking industry is characterized by dynamic small firms, used to work in partnership and subcontracting with SOTETEL and international vendors (Alcatel, Nortel Siemens). Telecommunications infrastructure development can be an occasion, in the medium term, to develop a **high-quality export-oriented networking industry**.
- There is a possibility to exploit the market potential of niche telecommunications services for the European market, notably for **the development of services to support the wireless data industry**.²¹ **in the development of services to support the wireless data industry**, with special attention to the European markets in such areas as solutions for wireless information services or wireless trading²². Another example of the potential for services development in the wireless industry is wireless corporate network services, including wireless PABX and value-added services over mobile private networks, like the real-time client-supplier exchange of information.

Impact. Telecommunications and networking services currently account for the highest share of revenues in Tunisia's ICT industry (70% of ICT turnover), but they show ample growth potential. Telecommunications revenues can grow from US\$ 370 M to about US\$ 1.3 Bn. by 2005. This growth would occur if the Tunisia's fixed line voice revenues were to match the growth rate of fixed line revenues on a global basis (8-10% annual growth rate, for countries opening up their telecommunications market), to strong growth in revenues from mobile, Internet and data services. This figure assumes the achievement of a 25% penetration in mobile telephony by 2005 and the expansion of the fixed line network to at least a 20% penetration level by that date.

Concerning **networking** services, assuming that telecommunications will grow at a 300% rate in the five years horizon, networking has the potential to grow at the same pace and generate, by the year 2005, **domestic revenues** in the order of US\$50-60 million. If, however, Tunisian networking firms will be able to position themselves on **global markets**, an additional US\$40-50 million in revenues could easily be generated, gaining a minor fraction of the European African and Arab market for networking, which is expected to be in full expansion in the next four years. The achievable objective of US\$100 million in revenues from networking services by 2005 will mean to expand the present pool of workers in the networking industry from 800 to about 3000.

The joint effect of the development of the revenues within the telecommunications sector, and its impact of this growth on networking and advanced telecommunications-related services, has the

²¹ According to Nokia, 10 % of mobile communications revenues comes from data services.

²² At present, for example, over 1 billion Short Messaging Services (SMS) are exchanged every year in Europe (half a billion on the German and Italian market alone). The boom in SMS services is just an indication of the potential demand of the wireless data industry.

potential to bring the contribution of telecommunications and networking to US\$1.6 billion, for a potential job creation of 23,000 jobs in four years, by the end of 2005.

D. Strengthening Domestic Drivers of ICT Development

There could be enormous opportunities in the local Tunisian market for all the above services. In effect, much potential remains for the application of ICT services in the Administration, private enterprises and households, in comparison with the levels achieved in other emerging economies. The expenditures of the Administration and the private sector on ICT services today represents less than 0.7% of GDP compared to between 2% to 3% in OECD countries. In 2001, the local Tunisian market generated DT 50 million of turnover. In 2005, this market could generate DT 300 million and create 5,000 direct and indirect jobs.

a. Administration

IT was introduced in the administration some time ago, in order to improve its efficiency and productivity. The recent use of the most modern technologies has permitted the establishment of instruments that facilitate administrative procedures such as the export import formalities of SINDA and Tunisia Trade Net. Other, more ambitious projects, such as video training are also in the process of being launched. The most significant projects are the following:

Two educational networks: The Tunisian government has launched an ambitious program aiming at generalizing the use of the Internet in education across the country. The program has been designed to provide teachers, researchers and students tools of communication that will improve interaction within the community and encourage the use of modern pedagogical instruments. Thus, the government has introduced computers and Internet in primary and secondary schools, as well as universities. Two national networks have been implemented:

- The national university network (RNU), which connects 87 universities, 21 of which are connected by specialized links. This network is managed by the Centre de Calcul El-Khawarizmi (CCK).
- The EDUNET network, which connects 337 secondary schools and 40% of the 650 preparatory colleges. For the primary schools, a pilot program is currently active which connects 10% of the 4,500 primary schools in Tunisia. This program is managed by the l'Institut National de Bureautique et de Micro-informatique (INBMI). By 2004, the entire Tunisian network ought to be connected.

In addition to this, the program has enabled the establishment of technology centres in disadvantaged areas that introduce information technology to the youth.

Research network: The National Network of Research and Technology (RNRT) was created in 1993 and connects 22 research centres at present. Many research programs use the network to improve the quality of audio and video transmission services on the Internet. The RNRT is administered by the IRSIT.

Health network: The National Health Network (RNS) is administered by the Information Centre of the Ministry of Public Health (CIMSP) and connects over 84 institutions:

- all the university hospital centres;
- 44 regional and district hospitals;
- the 23 Regional Heads of Health Units.

This network will include telemedicine and will allow the improvement of the quality of health services in rural zones by drawing from the competencies of the qualified medical personnel concentrated in the urban centres.

Agricultural network: The National Agricultural Network (AGRINET) is administered by the IRESA. It connects 14 institutions of agronomical studies and research across the country, as well as 7 regional poles of research. The connection was broadened at the Ministry of Agriculture, with the addition of all the regional departments of agricultural development all the technical units of the Ministry and the agricultural observatory.

The Tunisian administration can draw from these experiences to increase its usage of ITC in order to become more efficient and user friendly. The use of ITC could be implemented at different levels::

- At the internal management level;
- At the level of its relations with the citizens (A2C),
- At the level of its relations with the private sector (A2B),
- At the level of its relations with other administrations (A2A).

b. Enterprises

At present, only a small number of Tunisian enterprises use ICT in their operations, although the share of companies in different sectors that have PCs and use communication technologies is significant. The sectoral estimates indicate the following rates (not including SMEs): hotels 70%, restaurants 20%, travel reservations (100%), travel management (very low rate), animation and leisure 20%, textile and clothing industry 80%, electrical component industry 90%, agro-industry 90%, and banking 100%. A recent survey by the Ministry of Commerce shows that only 5% have access to the Internet, and 2% use the Internet for supply-chain management, and 1% use it for e-commerce. Les entreprises tunisiennes représentent donc un marché important compte tenu de leur faible taux d'utilisation de l'informatique. A part le secteur bancaire où toutes les banques de la place sont informatisées et s'échangent des données à travers un réseau national et à travers le réseau SWIFT à l'international, les autres secteurs sont faiblement informatisés.

Additional business opportunity arises from increased ICT applications for business operations (e.g., e-commerce activities). Driven by proliferation of the Internet, e-commerce activities are geometrically increasing worldwide. According to the ITAA, from some 400 million Internet users today, some 1 billion Internet users are projected by 2005, the majority outside the U.S., with an increasing share in developing countries. E-commerce sales are projected to increase from some US\$800 million globally at present, to over US\$3.6 trillion by 2004, with an increasing share expected from developing countries.

Box 1. India's Success in Software and Electronic Commerce

India has been successful in developing and expanding an high technology industry in a very short time in an economy characterized by low purchasing power and weak domestic demand.

About 280,000 software engineers are employed in about 1,000 companies in the country and market capitalization of India IT industry reached 24.3 Bn. US\$ in September 1999, jumping from 13.6 Bn. US\$ only six months before. The share in software exports has increased, from 1.75Bn. USD 1 year ago (5.13% of total exports), to 2.65 Bn. USD in March 1999 (7.1%) and is expected to be as high as 4 Bn. USD by beginning 2000 (10.25%). India exports over 60% of its software to North America, and another 23% to Europe. Government estimates that by 2008 the amount of exports in software will exceed 50 Bn USD. Prospects of export growth have fuelled stock market capitalization of IT firms, whose market capitalization has soared from less than 2 Bn. USD in 1997 to about 25 Bn. USD nowadays (equivalent to 5.8% of GDP)..

Progress in the area of software, and in particular, electronic software delivery, EDS, made possible the development of a strong e-commerce industry, where India is leapfrogging richer and more advanced economies. A report from ITU summarizes some of the strength of the Indian e-commerce development. "In India, electronic commerce is expected to grow from approximately US\$ 3 million in 1997, to an estimated 160 million by 2001. In 1998, 81 per cent of Indian companies felt that the Internet will have an enormous impact on the way they do business. [*Thanks to Internet-friendly policies*] India could become a major player in cyberspace. In November 1998, the Government ... [liberalized] the ISP market by issuing licenses to private ISPs. Some 50 companies are reported to have taken advantage of the new policy that allow direct international access and the possibility to up to 49% foreign ownership. Other positive steps from the Government include proposals for favorable taxes [...] and a new ruling to cut leased lines charges by 60 to 90%." (ITU, Challenges to the Network: Internet for Development, 1999).

Critical factors of the success in India have been:

- ❖ Liberalization of the telecommunications infrastructure;
- ❖ Investment in the information infrastructure;
- ❖ Focus on high skill IT training;
- ❖ Development of venture capital and creation of an exchange for high tech SMEs.
- ❖ Export focus on affluent export markets (USA, UK).

Source: The World Bank, ITU, Financial Times.

In 1999, e-commerce activity in the MENA region was limited to less than US\$100 million in annual sales, a small share of the global market, centered mainly in the Gulf countries. By 2002, this figure is expected to increase dramatically to more than US\$1 billion.²³ The number of Internet users in MENA today is estimated well over 2 million, a significant increase from the 780 million users recorded in 1999.

Tunisia has been early to recognize the benefits from the Internet and has implemented a number of far-reaching initiatives to facilitate Internet access and e-commerce activities. These include promulgation of e-commerce and digital signature bills; launching of various pilot projects to stimulate e-commerce (e.g., Tunisie TradeNet, Virtual Souk, etc.); implementation of the e-dinar and other related payment initiatives; enhancement of telecommunications infrastructure and lowering of rates, promotion of private ISPs, and rapid development of PubliNets.

The development of e-commerce and e-government activities provides a number of important commercial opportunities. These include (i) the creation of web sites and web based content; (ii) development of software, especially web based ASP applications; (iii) networking and software integration services; (iv) advertisements and multimedia; (v) improved and expanded payment applications and technologies, etc. In general, they provide an important stimulus to the further upgrading of the capabilities of Tunisian software, services and technology firms.

²³ According to projections by the Intel Corporation.

In the realm of commercial e-commerce applications, however, the scope for growth lies within B2B rather than B2C activities. The small and stagnating number of Internet hosts ²⁴(87 top level domain names against 907 in Jordan and 5,848 in Egypt) the limited use of credit cards and the limitations on application of the e-dinar model; limited computerization and public awareness, etc—all suggest that the growth of business to consumer e-commerce will be limited. There are immediate good opportunities, such as **e-banking**, as Arab banks seek to modernize to meet greater foreign competition. This will stimulate enormous spillover activities.

Although the majority of the Tunisian SMEs have had some experience with IT, the usage of it is generally confined to a few specific applications (invoicing, personnel payment etc.) and rarely spread to most of the companies' activities. Few enterprises have integrated solutions and those who do possess them do not take sufficient advantage of them. This situation is primarily due to a lack of credibility in the immaterial, which translates itself into the current levelling programs of which investments in the immaterial (including IT, studies, assistance, quality certifications etc.), constitute less than 7%, with a 38% rate of achievement.

The rate of Internet utilization by private companies is also low. In spite of the numerous advantages this medium brings, the number of enterprises employing it to communicate with partners or for researching partners, is not high enough. The ones that do use the Internet have frequently been pressured by their partners to do so. The number of websites is also low. (only 83 domain names).

The competitiveness of Tunisian enterprises is closely correlated to its mastering of IT and its capacity to obtain rapidly and timely the necessary information to reach a decision. Throughout the years, information systems have gone through the following stages:

1. Automation of the processing of transactions,
2. Automation of independent functions such as human resources, commercial management etc.,
3. Connecting different activities of the enterprise,
4. Unifying the enterprise information system in order not to differentiate between the various company activities, thereby becoming a tool for decision-making,
5. Focusing the information system on client services,
6. Opening the company to its partners (clients, providers...), thereby becoming a communicating enterprise.

The information system becomes the mirror of the organisational system of the enterprise.

The above figure defines the future concept of the company's information system. To organize the Tunisian enterprise according to this model would enable it to become reactive, if not proactive, to successfully face the international competition it soon will be confronted with, in addition to develop the ICT sector.

The implementation of sectoral portals (tourism, textile and clothing, agronomy etc...) will give the sectors international exposure, sensitize the Tunisian enterprise to the benefits of IT and introduce it to e-commerce, be it B2B, for its relations with its economic partners, or B2C for direct sales. However, for the development of B2C, it is necessary to introduce new methods of payment.

²⁴ Internet Hosts as Top-level domain names, Network Wizards report, January 2001 (<http://www.nw.com>)

Therefore, attaining these objectives could be achieved with the following methods:

- Sensitizing Tunisian enterprises to the advantages posed by the immaterial and the importance of information systems,
- Include the information system component in the levelling measures suggested,
- Incite the enterprises to adequately take into consideration the assistance component when acquiring logistical solutions,
- Encourage the development of ASPs (Application Server Providers), which permit the SMEs to use information applications on the web by paying a fee, instead of investing in them,
- Increase the bandwidth and reduce the costs of communication and data transmission, so to enable Tunisian enterprises in the country, as well as abroad, to have IT on all of their sites, and thereby to be able to reply rapidly to all of their clients.

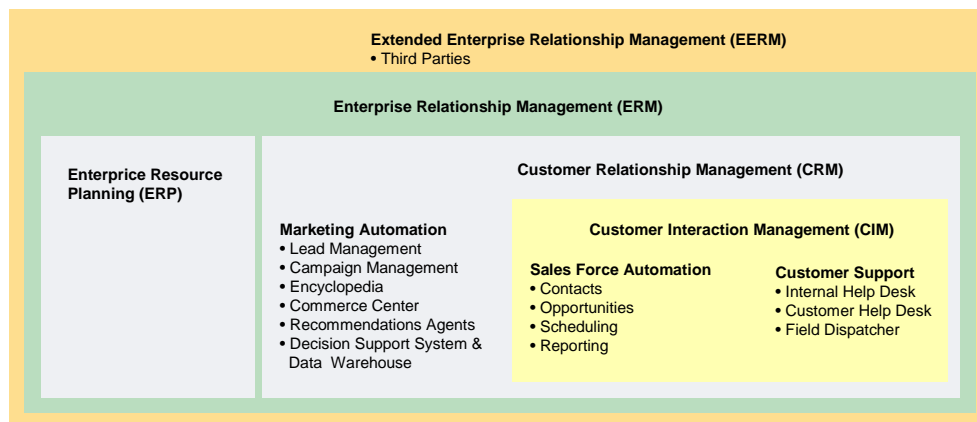
Achieving these objectives would generate equipment, software and services needs in the order of US\$ 50 in equipment and US\$100 in software and services.

c. Households

The latest presidential measures concerning the family computer paved the way for the development of the micro-computer assembly industry, and also popularized the use of IT, contributing to it becoming a widespread culture.

Internet access was equally facilitated by the various tariff reductions and by the opening of more than 200 publinets throughout the Republic.

The Family Computer program aims at generating 50,000 computers over a five year period, which would lead to a turnover of US\$50 million in equipment only, in addition to the Internet connection charges, which could add up to over US\$2 million in terms of internet subscriptions and telephone communication. The cost of a monthly family subscription to the Internet is DT11 TTC and the monthly cost of telephone communication is approximately DT 30 for one hour of connection per day.



Ireland's focus on the high-value software development and telecoms markets

Commonly referred to as the "Silicon Valley of Europe," **Ireland is now the leading high-tech center outside the United States** and home to the European headquarters of industry giants such as Microsoft, Intel, Dell, Informix, Oracle, CBT Systems, Gateway, Compaq and Apple. Ireland produces more than 50 percent of the world's Pentium chips. More than 40 percent of all PC packaged software, 33 percent of all PCs and 60 percent of all business application software (what we call elsewhere in the report shrinkwrap or packaged software) sold in Europe is produced in Ireland.

Ireland has been a leader in ICT training for its working population. The recent government announcement of US\$56 million for Internet skills training over the next three years indicates a recognition of the important role that Internet skills play in supporting Ireland's national objective of becoming a leading e-commerce economy. According to a recent report by IDC, the Irish IT training and IT education market is forecast to increase by US\$33 million in 2001. At the heart of the Internet training is the **Certified Internet Webmaster program (CIW)**, which is rapidly becoming the standard designation for Internet professionals. The family of CIW certification programs provides a complete roadmap for individuals seeking to develop creative, administrative and supportive Internet/intranet skills, and for businesses looking to define the essential skills needed for e-business solutions by job roles. CIW covers foundation material for the generalist, as well as tracks designed for those desiring to be certified in **seven different job roles**, including *site designers, application developers, enterprise developers, server administrators and internetworking, security and e-commerce professionals*. The Association of Internet Professionals and the World Organization of Webmasters endorse the CIW certification program. The certification testing program are administered worldwide by testing leader Sylvan Prometric.

Inward investment by information technology companies has been one of the keys to Ireland's prosperity, and the country is now attracting large e-commerce and other internet-related investments. Irish airline Ryanair now sells more than 40 per cent of its tickets via the internet. Last month the Irish Stock Exchange launched ITEQ, a market specially designed for the growing number of technology companies in Ireland. Distance learning, has been colonised by SmartForce, a company funded in 1984 to specialise in computer-based training (CBT), now positioned as a leader in internet-based solutions for learning. Ten years ago the company had 40 staff, now it has 1,200 and 70 per cent of its revenue is generated in the United States.

Recently, the **founding of MediaLab Europe** in Dublin, as the first offshoot of the famous MediaLab at the Massachusetts Institute of Technology, has made the news headlines. The project, including a multimedia village that the government hopes will attract foreign and domestic companies specialising in multimedia products and services, will cost \$130 Million pounds over 10 years.

Other large e-commerce-related inward investments include the announcement in July by IBM that it is to invest \$100 Millions to make its Mulhuddart research and development campus the portal for all IBM suppliers in Europe. The company expects that more than 90 per cent of its orders and invoices will be processed via the portal. Similarly, Oracle Corporation, the software company, recently announced plans to create 400 jobs at an international e-business centre in Dublin, to support its operations in 35 countries. Fujitsu is building a Pounds 29.4 Million engineering centre for communication technology products in Belfast. Nortel, of Canada, reported a Pounds 30 Million investment in fibre optics in Northern Ireland, as well as the creation of 750 new jobs at its existing optical internet and high-speed electronics plant in Monkstown, its largest systems house in Europe.

The Irish government's e-commerce strategy **encourages Irish small and medium enterprises (SMEs)** to adopt e-commerce, and offers a bill payment system set up by the Irish post office, giving taxpayers the option and the incentives to file income tax returns over the internet.

It is also promoting the **development of the telecoms infrastructure** to increase the reach of broadband networks. One of the important government initiative in telecoms was the signing, of an agreement with Global Crossing, the US telecoms operator, to provide an internet-ready broadband network. This will give Ireland almost unlimited broadband links to Europe, the US and Asia. Today Ireland has seamless access to 24 cities around the world. The Irish government also made the case to the European Union that e-commerce infrastructure projects should be grant-aided in the same way as road building or other physical infrastructure projects. One of the first projects to benefit from this was Internet Trading Community Hub (ITCH), which received a grant of Euros 350,000. ITCH

E. Future directions

Software and Professional services

As argued above, the market for software and IT services has the potential to grow from the present US\$ 50M to about US\$ 300M in 2005 and highlighted the fact that 4 factors account for the rapid growth of this market: (a) Internet diffusion and its implication for information systems and business modalities; (b) skill shortages and changing ICT human resource needs of enterprises (in the USA, this shortage was 1.6 million ICT workers in 2000 (AAIT) and 1.2 million in Europe (IDC)); (c) the outsourcing patterns of large enterprises and multinationals searching to reduce their costs, increase their market response and flexibility, and easy access to technical personnel; and (d) deregulation, consolidation and globalization of enterprises that has called for stronger and more flexible information systems.

Tunisia has two options to take advantage of these opportunities: follow the model of surplus labor countries (like India) or become a “hub” for investments and networking for high value software activities. This Chapter argues that “**hub model**” would be more appropriate to Tunisia’s conditions and assets, since it does not possess a pool of excess labor at the moment. On the contrary, the existing and potential pool of labor is highly skilled, and can meet the challenges of a hub for high value software activities. In addition, the several incentives in favor of foreign investment present in Tunisia make the hub feasible and attractive for foreign investors. However, to create long-lasting reliable development of the software and IT applications industry in Tunisia, the hub should be such that it not only attracts foreign firms but also establishes growth opportunities for local software and IT companies. This consideration is important for two reasons:

- Some leading software companies, offering large scale packaged software, like Microsoft and Oracle, seem to have already chosen other countries as main location for the region (Microsoft in Morocco, Oracle in Egypt).
- Tunisia needs to beat competition offering not only services of diffusion and development of packaged software, but also an adequate environment to develop flexible customized solutions. In this sense, it needs to create a network of local software services enterprises around the hub. For this reason, Tunisia needs not only to look at companies like Microsoft and Oracle, but also at companies like Gemplus, SAP, Schlumberger, Logica, Tibco.²⁵

Elements of a strategy for software and services development. A strategy for the development of that segment of the Tunisian ICT sector must promote the positioning of Tunisia into the global software market, as foreign demand will be the main driver of growth. The strategy will also need to facilitate the development of market niches in the high-end segment of packaged software. The strategy would involve the following pillars:

- **Build on the existing potential of Tunisia**, which includes highly skilled engineers and software developers, and experience with successful software start-ups and established firms such as BFI, SPG, etc. The strategy would need to overcome bottlenecks which could compromise this potential. These include:
 - a shortage of human resources in engineering which will grow larger with the projected expansion of the sector;
 - limited capabilities in marketing of export-oriented start-ups;
 - often defective business plans which shorten the life of high-tech companies.

²⁵ Possibly, ‘vertical’ sector software clusters should emerge. It is not a case that the most successful software company in Tunisia, BFI, serves the banking/financial sector.

The survey shows that many other existing firms are facing constraints, especially in the sense of access to qualified labor, as well as issues in the regulatory regime (related to measures 8 and 10 below).

- **Encourage Foreign Direct Investment in software development and software services.** This will be key in enabling Tunisia to move up in the software value chain. Main elements of an enabling environment for FDI include: (i) Better enforcement of Intellectual Property Rights, by ensuring a prompt and low-cost application of the existing legal framework; (ii) Securing a low-cost infrastructure, especially access to the Internet, to guarantee immediate delivery to the client of software applications, upgrades, patches, backfixes, etc.
- **Secure adequate supply of finance to high-tech start ups.** High tech start ups face limited supply of finance as they are risky and have only limited access to bank financing. Main steps of the strategy should include: (i) Encouraging the deployment of venture capital by facilitating the design of efficient exit strategies of private investors; (ii) Building private – public partnerships, to establish better communication networks between venture capital financing firms and professionals of the ICT sector, and improve local expertise on the evaluation of IT projects; (iii) Encouraging the development of the Tunisian stock market, and the creation of a “New Market” with lower listing standards, targeted on high-technology SMEs.
- **Develop competencies** in new and promising areas (signal treatment, real time, telecom software, knowledge management, mobile Internet, ASP)

ICT -enabled services

Capturing this market will entail sustained implementation of a number of strategic actions:

- Geographical Focus: Target companies in Europe (France, Italy) and target the Arab countries (Saudi Arabia, UAEs, etc.); and possibly the English speaking European markets.
- Creating a Tunisia “brand” and awareness. This is critical to create the momentum necessary to enter higher end IT services activities. There is a limited market perception of Tunisian potential currently. Awareness and Publicity campaigns, sponsoring international tours of Tunisia amongst potential clients is a must.
- Development of new markets especially oriented towards the English speaking countries
- Development of new services such as reservation and hotline systems
- Manpower development in specific skills. Educational and training partnerships can be established with leading educational companies that specialize in data conversion, voice center and related activities. The skill requirements of these operations are different than for software operations. Using the Fond 21/21 initiative to identify educated unemployed students in humanities, social sciences, communications, foreign languages etc. to operate the customer service centers.
- Increasing the international gateway bandwidth

With respect to ICT-enabled services, the strategic positioning and the assets of Tunisia, are such that the areas where the advantages seem to be the greatest are the following:

- **Centres de réservation**, due to the multi-lingual knowledge of Tunisian skilled labor and to the good perspectives of this market segment internationally (there is however, strong competition);
- **Customer Support** (similar considerations).
- **Engineering and training**, especially for the francophone markets.
- **SIG/numérisation**, thanks to low cost manpower.

In addition, Tunisia needs to build strength in some '*vertical markets*', to be recognized as a specialized provider of software services to a particular industry. Finally, it needs to reinforce its business efforts and presence in specific geographical markets (France and Italy, North European markets).

Potential vertical sectors, where Tunisian ICT-enabled services can have an advantage in foreign markets, are automotive, travel and tourism, healthcare, textiles and clothing, communications, and finance and banking.

Several horizontal measures, presented above, will have a direct impact on the development of software and ICT services, and especially:

- Developing a brand for Tunisia as a Favorable Business Location (FBL) for firms in the ICT sector (eTunisia).
- Implementing a program to fund 10 Technological Incubators
- Increasing bandwidth
- Encouraging the presence of specialized data operators and

In addition to those measure, the following suggestions are specific to ICT-enabled services.

Advanced media services

The model for development of the advanced media sector in Tunisia, can follow two main paths:

- Opportunities, in terms of local employment and subcontracting for Tunisian firms, arising from the **presence of global multi-media companies in the country**. A first example is the investment of the multinational @Home in Tunisia, which involves digital content creation activities. To achieve this, Tunisia must develop: human resources, strengthen IPR enforcement, relax content regulation, encourage more ISPs (to ensure more specialization in applications), and effectively regulate convergence.
- **Development, through remote real-time interaction, of business with companies in digital content clusters**. It is worth remarking that the firms in this market segment are highly concentrated in urban clusters (London, New York and Los Angeles). If the Tunisian firms want to have a significant international presence, they need to target firms in these areas and develop effective partnership relationships.

Telecommunications and Networking Services

To fulfil the growth potential of the telecommunications industry (see Chapter 4), a number of enabling factors would need to be in place:

- Encourage **Foreign Direct Investment** in the sector through: (a) the opportunities given to international operators to invest in new offered licenses; and (b) reduction of regulatory risk, through the strengthening of autonomous, independent sector regulation (see above).
 - Market share of **international transit communications can be increased**, provided Tunisia expands the capacity of its international infrastructure. The creation of a teleport within the existing science and technology parks, could attract a share of the international traffic.

- To position itself in the **development of services to support the wireless data industry**, Tunisia needs to: (1) attract international investors in the mobile sector, to develop RDT centers in this area in Tunisia, and engage the international investor in the development of training programs for engineers in the wireless services industry.
- Upgrade **networking skills**, through development and promotion of international networking certification in areas such as ATM/Frame Relay, Internet Protocol (IP) routing, IP traffic management, configuration and security, Virtual Private Networks, (with Cisco, Nortel, MCI WorldCom, Alcatel, Eriksson, etc.).
 - Developing **partnership** between foreign vendors and local networking firms, **to make Tunisia a favourable business location (FBL)** for the identification and use of networking skills
 - Increasing the **average size of networking and integration firms**. Pooling of different skill sets and different expertise is key to the access to European markets, and increased the bargaining power in sub-contracting arrangements with vendors and global sector players.

V. Economic Impact of ICT Development

A. Introduction

Tunisia faces the *twin medium-term challenge* of boosting growth—to create employment opportunities for a rapidly growing young population—and improving integration in the global markets by upgrading the quality mix of its exports. Growth spurred by a fast-track strategy of ICT development, holds a big promise of realizing this twin challenge.

The economic impact of ICT sector development will be felt in successive rounds. In the high-growth scenario, the *growth impulse* of ICT development will, first, be felt on the *demand side* of the economy, through booming spending on telecommunications and IT services—partly driven by domestic, and partly by foreign demand. But progressively, the impact will be transmitted to the *supply side*, through cost and productivity improvements in a wide array of *ICT-using* sectors.

This chapter examines the growth and employment benefits from ICT development during the initial rounds of ICT development, through increased ICT sector expenditure and one-off reductions in the costs of ICT-intensive sectors. The chapter provides only a rough assessment of the longer term impact through stepped up productivity growth, as these benefits will be felt beyond the time horizon covered by the strategy and their size is surrounded with considerable uncertainty.

B. Macroeconomic Impact of ICT development

With the right regulatory and business environment in place, taking advantage of the opportunities outlined above can significantly boost economic growth and employment generation through several channels:

- The increase in ICT sector expenditure would be a major short-term impulse to growth. But in addition to being a high growth sector *per se*, ICT growth could further foster growth and employment creation in other sectors of the economy:
- by generating multiplier effects on economy-wide expenditure, thanks to stepped-up investment within the ICT sector;
- by lowering the production costs of sectors making intensive use of ICT services;
- by increasing the effectiveness of production and marketing—thus fostering productivity growth—thanks to increased investment in ICT technology across economic sectors.

The macroeconomic effects from ICT development are likely to occur in *successive rounds*, with the impact first felt on the demand side of the economy and progressively transmitted to the supply side, through cost and productivity improvements in ICT-using sectors. The high-case scenario highlights a fully-fledged absorption of ICT benefits, along with the application of the strategy outlined in the Policy Note. By contrast, in the base-case scenario the benefits would be muted, reflecting a failure to remove the existing bottlenecks to the development of the ICT sector.

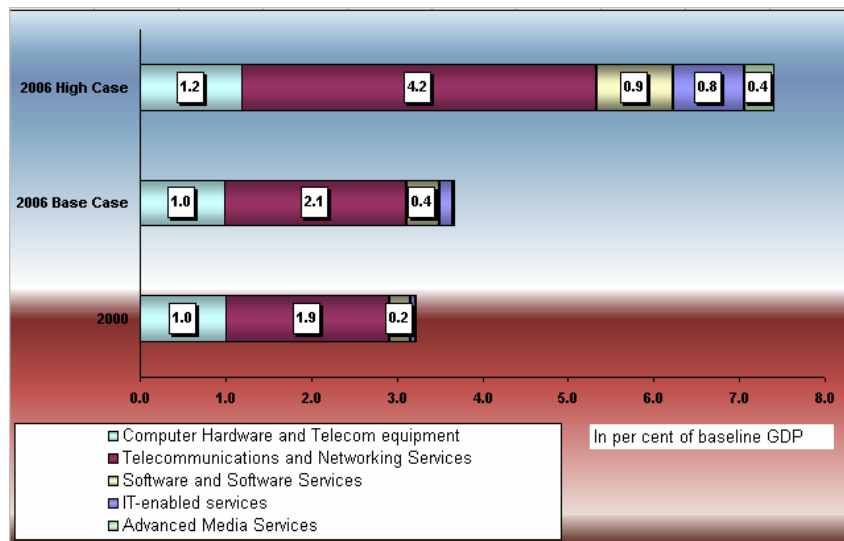
B.1. First-round impact: Growth spillovers from increased ICT expenditures

In the short term, the impact of ICT development on the economy will be mainly felt through the increase in ICT expenditures by businesses and consumers. In the high-case scenario, reflecting greater competition in telecommunications services, data transmission and advanced media, growth in ICT expenditures will be driven by lower user prices and by an expanding array of

services provided to users in both the telecommunications and the IT segments. Buoyant demand for fixed and mobile telephone services will be the main supporting factor, thanks to lower telephony prices to users. This will boost revenue in the telecommunications and networking segment, which is projected to grow to about 4.2 per cent of GDP in 2006, up from an estimated 1.9 per cent in 2000 (Figure 4.1).

Because of its low starting level, the IT segment will grow even faster than telecommunications services, with software and IT-enabled services realizing the most dynamic growth. Total expenditure on ICT (including telecoms) is projected to rise to about 7.5 per cent of GDP in 2006. By contrast, in the base-case scenario, while ICT expenditures will keep growing faster than the economy as a whole, their share in GDP will rise only moderately, to about 3.7 per cent (Figure 4.1).

Figure 4.1: In the high-case scenario ICT revenue would sharply increase



Source: World Bank staff estimates.

With *value added* in the ICT sector amounting to an estimated 65 per cent of total revenue, the share of the ICT sector in nation-wide value added could rise to about 4.9 per cent in 2006, up from 2.1 per cent in 2000.²⁶ Despite the boost to household income and business revenues from expanding activity in the ICT sector, the impact on GDP would be somewhat muted because other expenditures would be to some extent displaced by stronger spending on ICT services. Taking into account such effects, the increase in the overall size of the ICT sector would boost GDP by an estimated 2 per cent by 2006.

However, economic activity would gain additional momentum thanks to *spillover* effects. The increase in ICT output will stimulate investment in the ICT sector for the purpose of increasing production capacity. This will feed back into increased demand for the output of other sectors, generating *demand* spillovers for the rest of the economy. In Tunisia, investment in telecommunications over the past decade accounted for about 50 per cent of telecom revenue—

²⁶ The share of value added in ICT sector revenue is based on the estimated share in Tunisian telecommunications, scaled up somewhat to account for a higher value added share in the IT segments. As a benchmark, in Finland, the share of value added in production is about 60% in telecommunications and 69% in software and IT services.

with the average for middle-income countries at about 32 per cent. As the mobile and internet networks and the IT segment are less capital intensive compared to the fixed line network, the increase in investment stemming from ICT sector growth is projected at about 30 per cent of the increase in the revenue of the sector. In the high-case scenario, this would generate an estimated \$550 million additional investment expenditure in the ICT sector. The great majority of this increase in investment will come from greater private participation in the ICT sector, reflecting further deregulation of entry in fixed and mobile Telecommunications and a better enabling environment for investment in the IT segments. Public investment will be concentrated in Telecommunications services, where revenue is projected to increase by about USD 1 billion. Assuming that the public sector's market share in the revenue of this segment drops to 50 per cent by 2006 (i.e., to about USD 650 million), the increase in investment by the operators under public control could amount to about USD 85 million, out of the USD 550 million projected additional ICT investment. However, reflecting reduced investment in sectors suffering from demand displacement from increased ICT spending, the total increase in economy-wide investment could be somewhat muted, at an estimated \$400 million by 2006. The total investment share in GDP would thus increase by about 1.2 per cent by 2006.

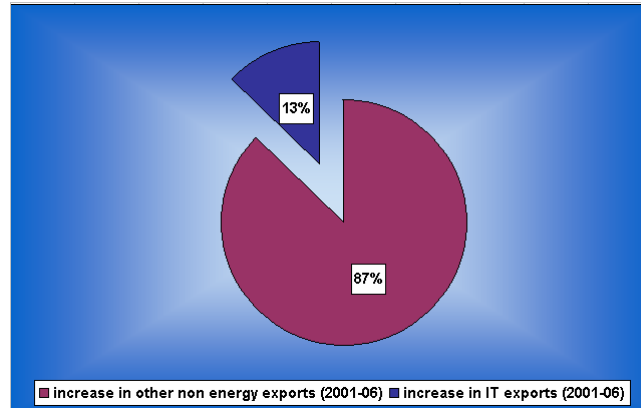
The increase in ICT sector investment will generate a multiplier effect by boosting incomes and expenditure in other economic sectors as well. Assuming an investment multiplier of 2, the ICT-driven increase in investment could boost the level of GDP by about 2.4 per cent by 2006.²⁷

- Overall, in the high-case scenario, the “first -round” spillovers would raise the level of GDP by an estimated 4.4 per cent up to 2006, lifting the annual growth rate from 2001 on by about 0.9 per cent. By contrast, in the low-case scenario, the increase in the annual growth rate would be about 0.2%.

Part of the growth benefits will stem from faster export growth, as growth in software and IT-enabled services will be mainly driven by foreign demand. Assuming that IT-enabled services are entirely export-oriented and that about 85 per cent of software and software services is sold to export markets, ICT development would boost Tunisian non-energy exports by an estimated \$ 500 million in 2006—or by about 5.5 per cent (high-case scenario). About 13 per cent of the increase in non-energy exports from 2001 to 2006 would come from growth in IT exports (Figure 4.2). This will significantly ease balance of payments constraints faced by Tunisia. As the import content of software exports and IT-enabled services is low, the reduction in the Tunisian trade deficit would nearly match the increase in ICT exports. Hence, the trade deficit could decline by an estimated 1.5 per cent of GDP in 2006.

²⁷ The apparent investment multiplier in Tunisia (annual change in GDP over annual change in gross investment) over 1988-98 is on average 3.2.

Figure 4.2: In the High-case scenario IT exports will significantly boost Tunisia's non-energy exports



Source: World Bank staff calculations

B.2. Second-round impact: Growth fuelled by declining production costs

Beyond the demand-driven impact on GDP, ICT development will also affect the supply-side, by reducing transaction and production costs of ICT-using sectors. In the projection period, up to 2006, declining telecommunications costs, stemming from greater competition, hold the biggest potential for reducing domestic production costs. But with the progressive spread of the internet and IT applications such as E-commerce, there is ample scope for further reductions of transaction and production costs. Though in some sectors—such as textiles, finance and tourism—cost savings could occur earlier, overall cost reductions will become more widespread beyond 2006, in a third round of ICT incidence on growth (see below).

International evidence suggests that ICT development spurred by greater market openness in telecommunications has the potential of enhancing productivity of labor in telecommunications (as measured by revenues per employee), thus creating room for lowering the cost of telecommunication services. Injecting greater competition would boost labor productivity in the Tunisian telecommunications sector by an estimated 60 per cent.²⁸ Assuming a similar increase in capital productivity, and taking as benchmark estimations for developed countries, the increase in efficiency could lower telecommunications prices by as much as 50 per cent.²⁹ Lower costs will also reduce prices because competition will force declining margins, with operators passing much of the cost savings to the users.

In Tunisia, telecommunications services represent 2.3 per cent of total intermediate business consumption, and about 1.2 per cent of total output (sales).³⁰ On impact, a projected lowering of

²⁸ Evidence across countries on the links between telecommunications sector liberalization and performance draws on findings presented in Varoudakis and Rossotto, "Regulatory reform and performance in telecommunications: Unrealized potential in the MENA countries", Mimeo, The World Bank, October 2001.

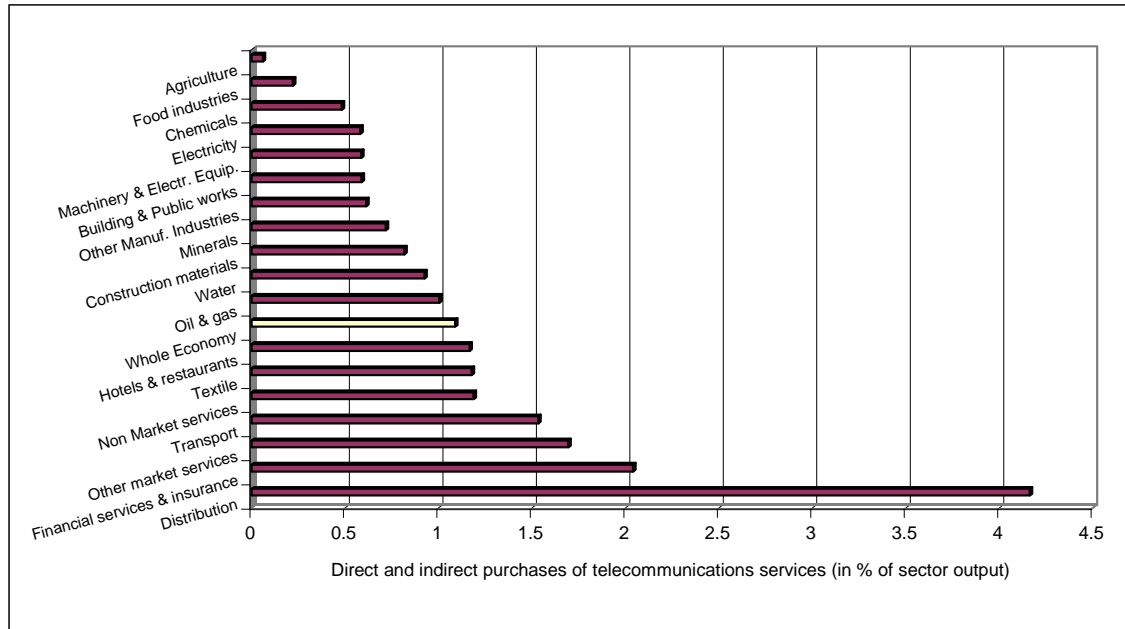
²⁹ Estimations of the potential impact of regulatory reform in telecommunications for eight industrial economies are reported in OECD, "The OECD Report on Regulatory Reform—Thematic Studies", Paris, 1997, Chap. 1, and also in Blondal and Pilat, "The Economic Benefits of Regulatory Reform", OECD Economic Studies, No 28, 1997/1. In the case, for example, of France, the estimated impact of a 40 per cent increase in labor productivity in telecoms is a 30 per cent drop in telecommunications costs, while in Spain, a projected 35 per cent increase in productivity is associated with a 22 per cent decline in costs.

³⁰ These estimates refer to the 1997 input-output accounts, in current prices. In the Tunisian Input-Output accounts telecommunications services are lumped together with Postal services. However,

telecommunications prices by 50 per cent could reduce producer prices for the whole economy by 0.60 per cent. However, in line with international experience, business costs could be further trimmed in the medium term—by an estimated 1 to 1.2 per cent in the whole—along with the increase in the size of the telecommunications sector and the more intensive use of its services by businesses. In the absence of a fully-fledged economic model, it is hard to assess the growth impact of the increase in supply spurred by lower producer costs. However, lower producer costs will help achieve sustainable growth, by averting a surge in inflation that could result—in the high-case scenario—from booming ICT expenditures and the increase in demand.

Industries that use telecommunications services more intensively would see their costs trimmed more sharply. The services sector, and in particular distribution, would substantially benefit from lower telecommunications costs (Figure 4.3).³¹ While, for the economy as a whole, halving of telecommunications costs would, on impact, reduce producer prices by around 0.6 per cent, costs in retail and wholesale trade could drop by as much as 2 per cent. If margins in the distribution sector remained unchanged, the reduction in costs would leave substantial room for lowering consumer prices, hence further raising the welfare impact of ICT-driven growth. Financial services, insurance, transport, and other market services (business services, real estate, repairs, health services, education) would benefit above average, with their costs dropping between 0.8 and 1 per cent. Hotels and restaurants and Non-market services (general administration, security, etc.) would benefit just about as the economy on average.

Figure 4.3: The services sector will benefit more from lower telecommunications costs



Source: World Bank staff estimates, based on data from INS.

Telecommunications represent the greater part of intermediate business consumption. Business consumption of telecommunication services is growing fast, as the share in total intermediate consumption was only 1.7 per cent in 1995.

³¹ The *indirect input* coefficients for telecommunications services (Figure 4.3) highlight the potential cost savings by sector. Indirect input coefficients account both for direct purchases of telecommunications services by each sector, and for indirect consumption through purchases of inputs from other sectors—which in turn make use of telecommunications services in their production.

- The stronger impact of lower telecommunications costs on the prices of key services will help contain consumer price inflation, as inflation in services is higher and much less flexible than price inflation of industrial and primary goods. In addition, lower cost of services in distribution, finance, and communications would greatly contribute to reducing transactions costs across the board, thus generating benefits for the economy as a whole.

Manufacturing, mining, and the primary sector would benefit less as they are less intensive users of telecommunications services, with the food industry being the least exposed to telecommunications among manufacturing.³² The textile industry is a notable exception, with an overall intensity of telecommunications services in production above that of the economy as a whole. Lower costs of telecommunications services will foster the competitiveness of the textile industry, which is strongly export oriented but faces increasing competitive pressure in international markets.

B.3. Third-round impact: Reductions in transaction costs and faster productivity growth.

Looking further forward, beyond 2006, growth in telecommunications and networking services will facilitate the spillover of transaction costs savings to the rest of the economy. Because greater competition in telecommunications will reduce access cost to the internet while encouraging the expansion of backbone infrastructure, it will also support internet penetration in Tunisia. Based on international evidence, liberalization in telecommunications would boost internet penetration up to about 20 hosts per 10,000 people. Tunisia would thus match levels now seen in better performing countries, such as Brazil, Chile, and Malaysia.

Increased internet penetration will provide a supportive environment for the diffusion of applications such as IT business services and E-commerce. The formation of a large mass of users will also pull demand for other IT products and services. Better network infrastructure, lower cost of data transmission, and the expansion of the IT services and software segments will encourage Tunisian businesses across industries to invest in ICT technology. This would facilitate the spillover of productivity improvements to a wide array of ICT-using sectors. Productivity growth will thus accelerate, generating permanent growth benefits for the economy. Moreover, the diffusion of e-government applications will lower the burden of transaction costs borne by the business sector; will spur efficiency and productivity; and will further stimulate domestic demand for ICT services.

Better internet connectivity and ICT applications will help businesses improve supply chain and inventory management, upgrade quality control, and adopt more efficient marketing techniques. Factual evidence from interviews with Tunisian enterprises suggests that the scope for such productivity improvements can be substantial, even in industries which do not intensively use ICT services.³³ Services are set to benefit more from the diffusion of IT applications. The

³² A similar pattern of incidence has been also found in other developing countries. See R. J. Saunders, J.J. Warford, and B. Wellenius, "Telecommunications and Economic Development", Chap. 5, The Johns Hopkins University Press, Baltimore, 1994.

³³ For example, even though food industries appear to be among the sectors that would benefit less from lower telecommunications costs, casual evidence from a company that has invested in IT solutions to improve quality control suggests that average annual productivity gains could be as high as 30 per cent. The internet can also be an efficient tool to improve marketing, as suggested by another company in the food industry which now realizes more than 40 per cent of export sales thanks to on-line promotion. The internet

Tunisian banking sector has stepped up investment in IT applications since 1997. The diffusion of E-banking and of electronic payments will boost banking efficiency, and help reduce operating costs and intermediation margins. The insurance sector could also take advantage of electronic payments and internet diffusion, leading to a substantial decline in marketing costs and an increase in the size of the market. The tourism industry would also reap significant benefits, thanks to better promotion and to reduced costs through improved co-ordination of reservation networks.

Many of the ICT improvements in business organization and networking are likely to boost efficiency in a one-off way, bringing it closer to international best practices. It is hard to assess the size of productivity-driven GDP gains, but in all likelihood they will be substantial. As a benchmark, according to estimates for industrial countries, the diffusion of B2B E-commerce alone could boost the level of GDP by about 5 per cent.³⁴ In Tunisia, the room for productivity improvements would be much greater, owing to the existing gap from international best practice.

But ICT applications also allow to link up technological developments more closely to businesses, and facilitate international technology transfers. This has the potential of *speeding up* the process of innovation and productivity improvement, thus boosting the rate of *Total Factor Productivity (TFP) growth*. Thanks to successful restructuring, TFP growth has accelerated in Tunisia, to an estimated 1.2 per cent in 1986-96 and 1.9 per cent in 1996-98, after remaining flat over 1973-86.³⁵ But, despite progress, TFP growth remains below that seen in other fast growing countries—such as Chile (3.8%), Ireland (3.4%), Taiwan (2.5%)—which have witnessed significant ICT sector development. The high-growth scenario for ICT development in Tunisia would lay the groundwork for an increase in TFP growth that could bridge much of the existing gap with successful global IT market integrators.

- While the growth impact of the first two rounds of ICT spillovers would progressively die out after 2006, as those effects boost the level of GDP only in a one-off way, more rapid TFP growth is likely to take over as the main driver of growth. The permanent increase in the long-run annual *growth rate* could be of about 1 per cent, closing much of the average gap with the fast-growing comparators.

C. The impact on employment creation

International experience suggests that ICT development has the potential of boosting overall job creation in the long term. Although, in the short term, some labor shedding is likely to occur in the telecommunications segment as a result of public enterprise reform and greater market openness to competition, there is a large potential for offsetting job creation from the emergence of new operators and services. Experience in other developing countries is that aggregate employment in telecommunications companies grows following sector reform, while new employment is created by sub-contractors, suppliers, retailers, and others.

In addition, faster GDP growth stemming from the economy-wide spillovers of ICT development has the potential of accelerating the pace of employment creation. In the high-case scenario, with an estimated average elasticity of employment to GDP growth of 0.6, the 4.4 per cent increase in the level of GDP by 2006, stemming from the first round of spillovers, would increase employment by about 2.6 per cent. Thus, about 85,000 additional jobs would be created until

also allows this same company to save an estimated 50 to 60 per cent on annual marketing costs, hence boosting its competitiveness and allowing a better positioning in export markets.

³⁴ Goldman Sachs, "The Shocking Economic Effects of B2B", Global Economics Paper No 37, February 2000.

³⁵ The World Bank, "Republic of Tunisia, Social and Structural review 2000", June 2000.

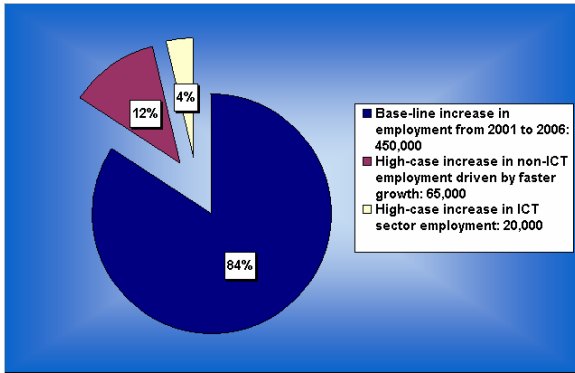
2006 in the economy as a whole—including the 20,000 new jobs that are projected in the ICT sector.

ICT sector development would thus have a high leverage on employment generation for the economy as a whole. While only about 4 per cent of the *new* jobs generated over 2001-2006 would be in the ICT sector, an additional 12 per cent of new jobs would be created thanks to faster GDP growth driven by ICT sector development (Figure 4.4a). Therefore, up to 2006, approximately *1 out of every 6 new jobs would be generated thanks to ICT-driven growth*.

- In the high-case scenario, the compounded increase in total employment by 2006—over and above an assumed baseline trend of 3 per cent annual employment growth—would lead to a decline in the overall unemployment rate, from a projected 11.6 per cent in 2006 to about 9 per cent. By contrast, in the base-case scenario the employment gains would be muted, with the unemployment rate declining to just about 11 per cent (Figure 4.4b).

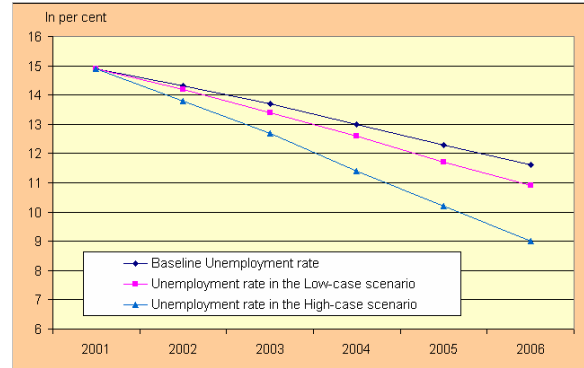
Figure 4.4: A high leverage of ICT growth on job creation

In the high-case scenario, ICT-driven growth will generate about one out of every six new jobs...



(a)

...reducing unemployment in 2006 by about 2.5 percentage points



(b)

Note: Base-line employment and labor force are assumed to be growing at annual rates of 3 and 2.4 per cent respectively. Estimates for 2001.

Source: World Bank staff calculations.

Moreover, cost savings and faster productivity growth stemming from the second and third rounds of spillovers, have the potential of further fostering employment creation. Higher labor productivity increases firm competitiveness and profitability, thus stimulating business investment and output growth. This has the potential of boosting job creation across a broader range of economic sectors.

But labor market flexibility is key to securing long-term employment dividends from ICT development. Job creation may be less responsive to ICT development if faster productivity growth is offset by steeply rising wage and non-wage labor costs. Growing labor productivity would, in that case, fail to significantly improve company competitiveness and profitability, with investment and output being less responsive to technological advances. The failure of a number of developed economies (especially in the EU) to convert productivity improvement into employment gains illustrates. Increased flexibility in the use of human resources will help firms better respond to new business opportunities provided by ICT and facilitate reorganization of

production. Greater use of part-time and temporary employment contracts, enhanced flexibility in hiring and severance regulation, and greater flexibility in working hours, are likely to increase the ICT impact on productivity and business efficiency, improving thus the potential for employment gains.

D. A balanced strategy would help manage the downside risks

The short to medium term impact of ICT development is subject to downside risks. These risks have been heightened by the recent “e-crash”, triggered by the sharp downturn in ICT investment in the US. As discussed in the Policy Note, how well Tunisia could position itself in the global ICT market, depends on the extent of the growth in this market.

Even though the downturn in IT spending (in particular, in software) is likely to be short-lived, with a recovery projected in the second half of 2002 as growth resumes, it will make it harder in the near-term for Tunisia to break through in the global market. But the medium-term growth outlook for Tunisia should remain positive. Importantly, the strategy will produce its full benefits over the medium-term, when the current slump is very much likely to be over. In addition, part of the growth dividend for Tunisia would be “home-driven”, stemming from declining costs of ICT services in production (the so-called “second-round impact”).

However, in the medium term, increased exposure to ICT exports may intensify the impact of global ICT cycles—as illustrated by the severity of the current slumps in East Asia (Taiwan, Singapore, Philippines). In view of the volatility of the global ICT market, and the downside risks associated with the near term growth outlook, it is particularly important that a *balanced strategy* be pursued. Addressing these risks calls for further strengthening the domestic drivers of ICT development: E-government; ICT investment by domestic businesses. Injecting more competition in telecommunications and networking services holds the key to bolstering domestic demand.

VI. Strategic Plan for Tunisian ICT Development

The Government of Tunisia has set an ambitious ICT development plan in terms of sector growth and job creation, for the period 2002-2006. The country's 10th Development Plan sets a target for the ICT sector to increase its share of revenues in GDP from 3.3% to about 8%. The sector's contribution to employment creation is also expected to be great. The report suggests that the Government's goals are largely achievable, provided sector policy is deepened and targeted towards the rapid elimination of existing constraints. The strategy is growth-based, aiming to bolster the country's emerging ICT sector; improve its ability to compete in local, regional, and global markets; and maximize the direct contribution of ICT to growth and employment generation. At the same time, the strategy lays the ground for further diffusion of the benefits of ICT development in the long term, through improved productivity and competitiveness.

The report analyzes the growth potential in eight interdependent segments of the ICT industry, shown in Table 1. It assesses global positioning of each of these segments and evaluates the macroeconomic impact of the proposed strategy. Implementation of the strategy is expected to lead to the high-case scenario shown below. By contrast, failing to remove existing constraints by implementing appropriate policy measures will seriously restrict the potential for ICT development, as shown in the base-case scenario.

Table 1: Potential Growth of ICT Sector by Segment

	2000		2006 BASE CASE		2006 HIGH CASE	
	Revenues (\$M)	Total Workforce	Revenues (\$M)	Total Workforce	Revenues (\$M)	Total Workforce
Telecom Equipment	100	1500	160	2800	200	3500
Telecom Services	370	8000	670	12000	1300	15000
Networking Services	25	800	50	1500	100	2500
Computer Hardware	100	500	170	800	200	1000
Software and Software Services	50	500	130	2000	300	5000
IT-enabled Services	10	200	40	1000	240	2500
IT Applications	3	50	10	250	40	1000
Advanced Media Services	2	50	10	150	120	2000
TOTAL	660	11500	1250	20500	2500	31500
Revenues as % of baseline GDP	3.3%		4.1%		7.8%	
GDP level	20,100		30,650		31,900	
GDP gains (against baseline)			0.8%		4.5%	

Note: The nominal growth rate of baseline GDP is set at 9%. The baseline employment growth is set at 3%.

A strategy to maximize economic spillover benefits from ICT development needs to be cast in an appropriate time frame. International experience suggests that the effects of ICT sector development appear in successive rounds, as more transmission channels of the growth impulse to the rest of the economy are activated. Moreover, depending on the time horizon and on the ICT market segment considered, the **drivers of ICT development** may be different.

In the short term, the primary driver of ICT development is the domestic market, at least in the case of telecommunications and networking services. However, growth in the IT segments is

likely to be driven by external demand over time based on the competitive advantages of Tunisia on the global and regional marketplaces. The report highlights strategic choices with the aim of taking full advantage of the **drivers** of ICT development by: (a) fostering the momentum of the domestic market in the telecommunications segment and creating the right infrastructure for ICT development; and (b) building on the competitive advantages of Tunisia in the global and regional ICT markets to boost growth of its ICT industry. In the high-case scenario depicted in Table 1 above, more than half of the projected 4.1 % points increase in the ICT sector's share of GDP would come from telecom and networking services. Because growth in these segments is driven by the local market, and the mobile network in Tunisia is smaller than its comparators, the overall downside risk from slower growth of the global ICT market is considerably reduced provided the right regulatory framework is put in place to foster local market growth.

The following is a proposed list of indicators, to monitor the progress of the sector over the next four years, towards a path consistent with the high-case scenario.

- ❖ Increase the number of Internet users from 4.1% to 20% by end-2006
- ❖ Increase the number of Internet accounts from 25 000 in 2002 to 300 000 by end-2006
- ❖ Increase PC penetration from 3% to 8% by end 2006
- ❖ Increase Mobile phone penetration from 4% in 2002 to 30% by end-2006
- ❖ Increase fixed line penetration from 11% in 2002 to 20% by end-2006
- ❖ Reductions in transaction costs in ICT-enabled sectors by end-2006
- ❖ Increase the number of Internet hosts (top-level domain names) from less than 100 in 2002 to 20,000 by end-2006. (source : Network wizards)

For a full discussion of the suggested measures, please refer to Volume I of the Report, "Information and Communications Technology Strategy – Policy Note".

A. Preconditions

A range of pre-conditions to create a competitive, information-based economy is required for Tunisia to realize the full benefit of an ICT revolution. First, Tunisia needs a flexible economy to successfully cope with the need for constant change and restructuring. A quick redeployment of resources is facilitated by an adequate competition policy, an efficient financial system (including the availability of venture capital) and flexible labor markets. This, in addition to the following factors related to ICT enabling environment, constitute what we call "preconditions" for the implementation of the ICT strategy. These aspects include: (a) information infrastructure; (b) the institutional, legal, and regulatory framework governing ICT; (c) skilled human resources; and (d) availability of appropriate financing for start-up and expansion of ICT enterprises. The key to leaping forward in ICT development is to strengthen Tunisia's assets and remove bottlenecks in these four areas identified as the main enablers of ICT growth.

(a) Developing an efficient information infrastructure. High-quality, low-cost competitive telecommunications and Internet infrastructure is a prerequisite for developing information intensive services, such as call-centers, electronic delivery of software, e-commerce, and other Internet services and applications. Government control and limited liberalization have for a long time constrained the development of an information infrastructure. Over these past years, however, some improvements have occurred, including partial competition at the ISP level and progress in establishing a pro-competitive regulatory framework in the sector. In addition, the Government increased the number of Publinets, developed technology parks, and introduced incubators in technical universities. Notwithstanding these efforts, the present information infrastructure would not sustain the accelerated growth that the strategy forecasts in the high-case

scenario. Notwithstanding recent efforts, it is clear that to realize the ambitious targets set by the Government, **bandwidth capacity must increase.**

(b) Establishing pro-competitive regulations and building institutional capacity. To encourage private sector involvement in ICT, the regulatory framework must be further elaborated with a view to develop competitive markets. Although Tunisia's new Telecommunications Code establishes the possibility of competition, the introduction of effective competitors has been slow thus far. A proactive policy for introduction of competitors in telecommunications needs to be strengthened. This requires regulatory reform to allow competing telecommunications operators, non-discriminatory choices of technical standards, transparent, open and competitive bids for selecting international operators and equipment providers, and enforcement of competition principles. To cope with these issues, three agencies (INT, ANCE & ANF) were recently created and are in the process of hiring professionals and establishing personnel rules. **Continued commitment toward development of adequate regulatory and institutional counterparts** is key to sustaining development of competition and involvement of the private sector.

(c) Developing skilled human resources. The key element for capitalizing the potential offered by the explosion of new knowledge and accelerating technical change is a skilled labor force. Ensuring that education expenditures are allocated efficiently and that the workforce has knowledge and skills needed to participate in the knowledge-based economy are Government priorities. Countries that have established the right conditions in terms of skilled labor development and an efficient labor market have substantially increased the number of jobs in the ICT sector. Current examples include Hungary, Malaysia, and India (International Labor Organization, 2001).³⁶ Tunisia decided to make the development of the country's educational system a priority, focusing on secondary and university education. In many cases, however, university graduates do not find an appropriate placement in the job market, resulting in unemployment or underemployment. To explore the full potential of the ICT sector for job creation, Tunisia recently created a *Parc Technologique des Communications* (Communications Technology Park), which offers facilities such as broadband Internet access and research, development and technology transfer (RDT) to ICT firms. This initiative includes training and incubation programs and partnerships with local universities. This is a first step, which should be developed and complemented by wider reforms, including the introduction of flexibility in the job market and programs to train workers in IT and communications. Sustained private sector involvement is also needed in the educational and training area.

(d) Developing adequate channels of funding for the ICT industry. Efficient capital markets and flexible financing are essential for the growth and development of ICT start ups. High-tech investment requires a higher share of equity financing than other more traditional investments. This places Tunisia at a competitive disadvantage vis-à-vis some of the competitors, as its capital markets are less developed and biased towards loans to large firms. For example, stock market capitalization in Tunisia was only 2% of GDP in 1999, compared to 10% in Egypt. Despite numerous Government initiatives to encourage financing of ICT firms, a lack of expertise in evaluating ICT project risks (rather than a shortage of liquidity) limits bank financing of these investments. The same is true for venture capital companies. There are 25 venture capital companies or *Sociétés d'Investissement à Capital à Risque* (SICARs), but they rarely invest in ICT firms (TUNIVEST being an exception). SICARs would therefore need to enhance their

³⁶ The ILO *World Employment Report 2001* indicates that the ICT sector currently employs 4.3% of the labor force in Hungary, a percentage that has been increasing steadily over the last 10 years, and that exceeds the EU average of 3%. Similarly, Malaysia and India boosted their employment in the ICT sector, thanks to the development of export-oriented, highly-specialized ICT firms.

capacity to evaluate ICT projects. Other measures that could increase possibilities for ICT financing are: (a) the development of an IPO (Initial Public Offering) market (such as NASDAQ or *Nouveau Marché*); and (b) incentives for institutional investors to invest in ICT projects. The International Finance Corporation (IFC) can play a major role in the development of adequate capital markets for technology ventures.

B. Broad-based, Diversified, but Focused Strategy

The rapid growth and dynamism of the global ICT industry and the resulting opportunities created for countries to position themselves in the global marketplace has two broad implications for a Tunisian ICT development strategy. First, the strategy must be **broad-based, or diversified**, initiating actions to respond to a broad range of ICT market opportunities, both internal and external, and across the entire ICT sector. International experience has shown the risk of relying narrowly on any one segment of the ICT services market.³⁷ Exporting services from different segments, will also make the development of Tunisia ICT sector less sensitive to a crises in international demand. Accordingly, Tunisia needs to focus on developing all segments of the ICT sector in order to achieve its growth objective. The second implication, however, is that the strategy needs to respond to **market niches and activities** where Tunisia has the greatest comparative and competitive advantages, especially considering the Government's intent to meet its ambitious targets by end-2006. This allows initiatives to focus on areas of greatest opportunity based on Tunisia's assets and global demand patterns, in order to maximize growth and employment generation potential. From the global positioning analysis of Tunisia, it emerges that the areas that present the highest potential are: (a) telecommunications and networking services; (b) software and value-added software services; (c) IT-enabled services; and (d) advanced media services. In addition, development of IT applications (e-commerce and e-government) also has growth potential, especially toward the end of the four-year period. A series of measures are presented in the strategy to facilitate growth in the above areas.

C. Priority Measures

The measures that constitute Tunisia's ICT strategy aim to create an enabling environment for ICT development according to the pre-conditions discussed earlier. These measures have different priority and different impacts on sector performance. The main measures are summarized in Table 2 below, indicating the implementation timetable and priority of action. Out of the 14 measures proposed in the five strategic axes, the core of the strategy can be condensed into six measures that assume priority and are associated with the highest growth generation and job creation impact. However, to reach the high-case ICT-growth scenario, it is assumed that all measures are implemented (and that favorable conditions on international ICT markets are maintained as well).

The key measures include establishment of a liberalization timetable for telecommunications, and **introduction of competition in all market segments** (see Measure 1 in the following section). The introduction of competition in telecommunications infrastructure and services would enable the establishment of an adequate broadband infrastructure to support all the other ICT market segments. In voice telecommunications, competition would drive telecommunications revenues to higher levels. A necessary element in establishing competitive markets is the **strengthening of the regulatory framework**, especially in telecommunications, to face the challenges of an open,

³⁷ Examples include India, which until recently has been highly dependent on low-end software outsourcing, and Singapore and Korea, which have concentrated on hardware activities to the virtual exclusion of software and services (World Bank, 2001).

competitive market. Since about 50% of the growth over the five-year term is likely to be telecommunications-related, these measures are key.

Other measures include the development of a brand name for Tunisia as a “Favorable Business Location”, and upgrading human resources in software and ICT-enabled services. The development of a brand name for the country is key to attracting FDI, and will facilitate networking efforts of Tunisian ICT firms. It will also allow Tunisia to consolidate consensus on the benefits of the new strategy and communicate them to domestic stakeholders and international investors. Human capital reforms are also considered crucial, due to the expected ICT expansion in Tunisia and the larger role the private sector will play. A program of incubators for ICT firms and start-ups is also necessary for the achievement of the ICT strategy goals, and its implementation should start no later than the second half of 2002. It should involve what the incubator literature calls the “triple helix” : private sector, government, policy makers and academia. Finally, among the proposed measures to enhance financial flows to the ICT sector, the proposed reform of the venture capital business environment is considered a key priority, because technology firms often fail to meet the financing criteria for traditional bank credit.

Once this group of measures has started to show results, complementary measures can be implemented to consolidate and diffuse growth. These additional measures could enhance the networking efforts of ICT firms by facilitating their access to equity funding and to training in ICT among Tunisian enterprises. Towards the middle of the time horizon, efforts could be placed on the demand side of the industry, through development of sector portals and enhancement of the role of the Government (e-government and outsourcing of the Government’s IT functions). At this point, the efforts of private and public sector stakeholders should be concentrated to promote the diffusion of e-commerce and advanced applications in the industrial and social tissue of Tunisia (improve payment systems, promote diffusion of ICT among enterprises).

Table 2: Key Measures and Support Measures for Tunisia’s ICT Strategy

2002	2003	2004	2005- 06
Award a 2 nd GSM license	Award licenses of Data transmission	Award 3 international Licenses	Award local and Ld licenses
Award a 2 nd GSM license	Award licenses of Data transmission		Award of retail operator licenses
			Full liberalization
			Full liberalization
			Award a third GSM license (in 2007)
Strengthen Regulatory Framework			
Develop Brand of Tunisia as Favorable Business Location for ICT			
Assist start ups in research for funds, preparation of business plan, national and international networking			
technological Incubators			
Change regulation on venture capital			
Create ICT Fund			
Facilitate « exit options » for technology SMEs investors			
Upgrade Tunisia Human Capital in ICT			
Outsource IT Procurement in Tunisian Public Administration			
Develop “e-government Program”			
Develop Sector Portals			
Develop e-payment solutions for e-commerce			
Make the private firms active elements in e-commerce			
<p>Key measures</p> <p>Support measures</p> <p>Intermediate liberalization Scenario GDP growth from 6 to 6.8 % in 2006</p> <p>Accelerate liberalization scenario GDP growth of 8 % in 2006</p>			

ⁱ Few large companies, mainly banks and insurance companies are listed. Few IPOs.

ⁱⁱ Billet de Tresorerie.